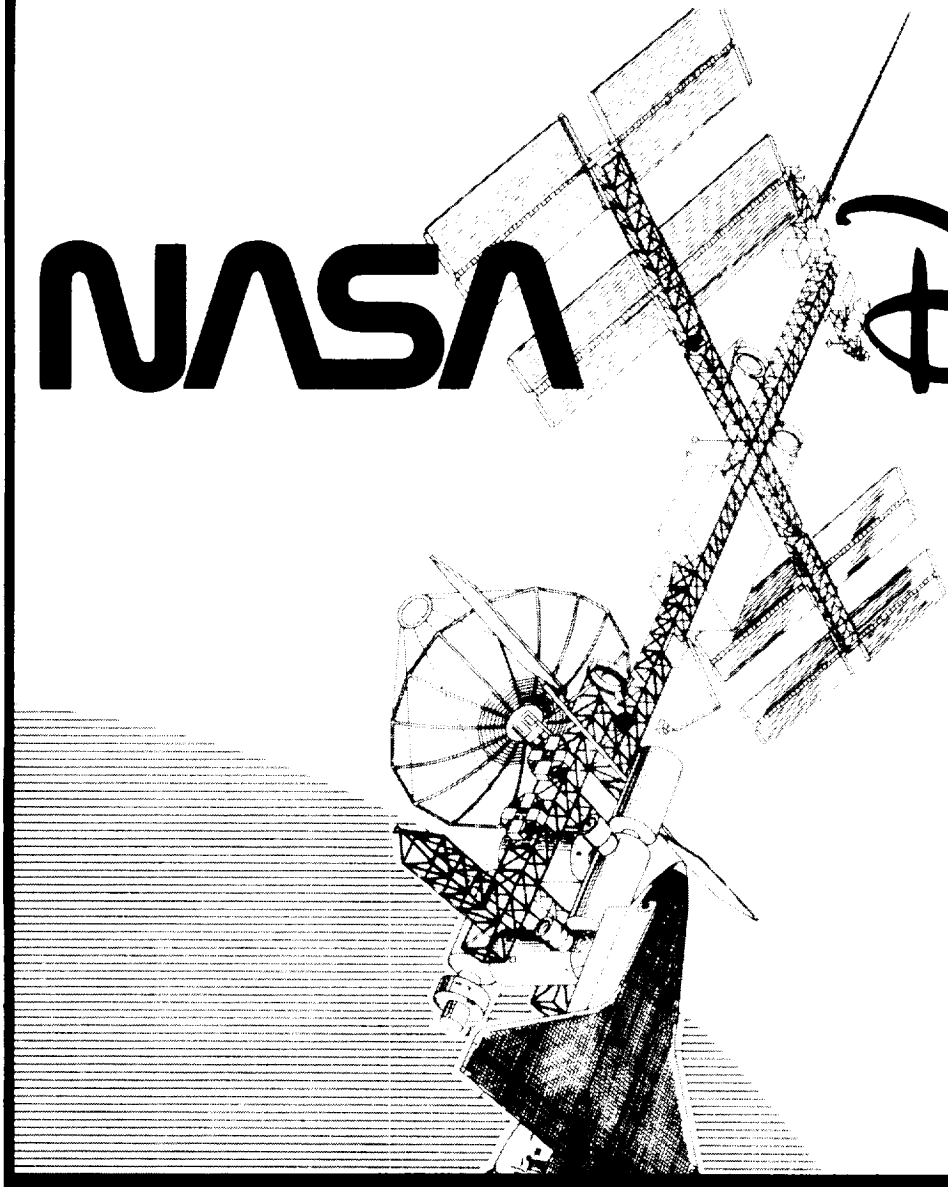
NASA-TM-111661

Walt Disney World
EPCOT CENTER



NASA Disney

Technology Demonstration Workshop

January 1985

NASA/Disney Technology Workshop

January 15-17, 1985
Walt Disney World

Technology Displays Concepts
June 1985

TABLE OF CONTENTS

I. INTRODUCTION

On January 15 through 17, 1985, approximately 35 select NASA scientists and engineers from around the country convened at Walt Disney World in Florida to participate in joint discussions with representatives from WED Enterprises, the engineering and design division of Walt Disney Productions. The objective of these discussions was to identify opportunities to transfer innovative NASA technologies to appropriate settings within and outside of Epcot Center. Consistent with the goals of NASA to achieve broader public awareness of the benefits of space exploration, and the commitment of Disney to present promising new technologies to Epcot Center guests, the meeting represented an exciting and logical step for both organizations.

To maximize the benefit of the workshop proceedings, a preparatory session was held in November 1984, involving key management personnel from NASA, the NASA Technology Applications Team at RTI, and WED Enterprises, California. At that meeting, Disney management identified the following criteria as relevant in evaluating potential Technology Displays for Epcot Center:

- The technology should be of significant public benefit or interest.
- The technology should be suitable for siting at Epcot Center or elsewhere within Walt Disney World.
- Sponsorship or cofunding should be available to minimize financial costs.

NASA representatives identified a complementary set of criteria:

- The recommended technology should incorporate NASA R&D objectives.
- Sponsorship/cofunding should be available from government and/or private institutions.
- The availability and role of key personnel within the agency should be properly defined.

It was agreed that concepts for technology display would be submitted in writing by each NASA participant in accordance with a designated format. These technology display concepts, included in Section III of this report, are to be reviewed by Disney and NASA personnel against the criteria above and appropriate concepts ultimately selected for implementation. Final approval to proceed with a project will depend upon a variety of factors including total cost, potential for co-funding, time to complete, compatibility with Epcot themes and display criteria, and availability of NASA manpower. Prior to implementation of each selected concept, a project plan will be developed, outlining specific elements pertinent to project implementation including scheduling, staff requirements, costs, and other support obligations of the individual participants.

II. EXECUTIVE SUMMARY

The NASA/Disney Technology Opportunity Workshop opened on Tuesday evening, January 15, 1985, with an overview of the workshop's purpose and a slide presentation by Disney personnel highlighting advanced technologies already employed at Epcot Center and on the Walt Disney World property. The objective of the workshop, it was emphasized, was to identify areas of mutual interest where NASA and Disney might work cooperatively to present significant new technologies to Epcot Center and Walt Disney World guests. These technologies fall into two principal categories: infrastructure systems, which are primarily behind the scenes, and show systems, which are an integral part of what is seen and experienced by guests. Among the prototype infrastructure systems operating at Walt Disney World are a water hyacinth wastewater treatment and energy production system, linear induction vehicle power systems, and a 40 kilowatt fuel cell. At Epcot Center, a variety of innovative show systems are employed including computer-aided-design simulations, random access video disk technology, lasers and holography, speaker-independent voice recognition, etc. When viewed in this context, the dialogue between NASA and Disney is a logical extension of Walt Disney's longstanding commitment to creating a proving ground for promising new technologies.

On Wednesday morning, the workshop participants toured Epcot Center and the Walt Disney World property to see these technologies first hand. The tour was structured to acquaint participants with the variety of technological systems already in place and to stimulate thinking in preparation for the discussion sessions to follow. These discussions began on Wednesday afternoon when participants were divided into smaller working groups: Communications and Computers, Energy, Space, Biological Sciences, and Transportation/ Materials.

By the close of Wednesday's discussions, consensus had emerged on several issues. Most significantly, there was unanimity among participants that there should be a Space pavilion in Epcot Center. This pavilion should be

dynamic and responsive to the space program itself. It should focus, for example, on living and working in space, space operations, the development of a functional space station, and real-time presentations of NASA exploration and research activities.

With regard to computer technology it was felt that, although state-of-the-art systems are employed behind-the-scenes, there are relatively few participatory activities for the average Epcot Center guest. The need was expressed for better use of computer graphics and simulation, optical disks, language transducers, and character recognition devices.

Considerable discussion centered on the issue of global habitability as viewed from the perspective of space. Remote sensing technology could be used to give guests a broader perspective of global resources management, environmental quality, and the interdependence of basic earth systems (land, atmosphere, oceans, and biosphere).

Finally, it was asserted that whatever the specific nature of the ideas submitted by workshop participants, the emphasis should be on process rather than product. This attention to process should be independent of whether the focus is on space, transportation, computers, or the like. The salient question is not simply, what are the leading edge technologies that will affect our lives? But, more importantly, how did they evolve and what do they suggest about what lies ahead? By helping guests to understand the process of technological change, we can enhance their ability to influence the future. This, it was suggested, could be the most important contribution Epcot Center can make.

On Thursday morning the small group discussions continued with each group working to refine specific recommendations for technology displays within their respective areas. These recommendations encompassed both infrastructure systems of a fairly technical nature, as well as exhibit or show ideas for possible inclusion in Epcot Center. A synopsis of each group's work was then presented during a closing plenary session. The following is a brief summary of these presentations.

Space

The creation of a Space pavilion at Epcot Center could parallel exciting new initiatives in space exploration. Foremost among these is

the development of an operational space station by NASA, scheduled for completion by 1995. As a major show element in a Space pavilion, a space station mock-up could offer guests a first-hand view of the challenges associated with living and working in space, simulated laser docking, materials processing, planetary exploration and colonization, etc. A space vehicle ride system simulating a planetary "Grand Tour" would give guests a spectacular and intimate view of the solar system. Related exhibits might be developed on lunar farming, orbital mechanics, and the deployment of NASA's space telescope. A real-time video link could be established linking Epcot with shuttle or space station activities either through the Kennedy Space Center or by direct satellite allowing live interaction between guests and crew members in space.

Communication and Computers

Interactive video disk technology offers numerous opportunities to stimulate guests in seeking solutions to the challenges facing "Spaceship Earth." The concept of a "Discovery Arcade" would allow guests to build a house, be the master of a space colony, or design a city, while testing their ability to make prudent decisions regarding resources, cost, and quality of life considerations. The technologies we employ to measure physical properties expand our understanding of the world around us. An exhibit focusing on the world of measurement, from the use of lasers to determine distance accurately to the use of atomic clocks to measure the time it takes light to travel several feet, would enable guests to explore a part of their world normally overlooked. Other ideas presented by the Communications and Computers group included "Library of the Future," demonstrations utilizing CAD/CAM technology and a satellite link-up to create a global paging system.

Biological Sciences/Global Habitability

The use of remote sensing technology to monitor and simulate Earth system functions could form the centerpiece of an interactive global habitability exhibit. Landsat generated data would enable guests to

better understand weather and climate, resource utilization, and geophysical phenomena. Guests would experience Earth from the perspective of its place in the solar system. The need for global responses to environmental issues, and the necessity for cooperative interaction at the international level, could be unifying themes. A second major area considered was biomedical applications of NASA technology. Here it was felt that a "Hospital of the Future" or Health pavilion at Epcot Center could shift the presentation of biomedical technology away from illness and corrective applications, to prevention and improved health. Examples of exhibits might include telemetry equipment for monitoring vital functions, cleanroom technology, exercise physiology, and predictive tools used for diagnostic purposes.

Energy

Conservation is the most important aspect of the progress we have made in the energy field and needs to be emphasized along with a broad spectrum of energy sources. A number of infrastructure improvements on the Walt Disney World property would further this objective. For example, since Disney has a degree of control over their distribution voltage they should investigate the possibility of maintaining voltage levels at their lowest practical level. This is determined by the nameplate voltage on induction motors. An exhibit based on the Power Factor Controller would illustrate the savings attainable where AC motors are lightly loaded, leading to significant energy savings for devices with variable loads. Finally, the use of heat pipe exchangers to increase dehumidification in vapor compression air conditioners could be employed in a variety of environments where humidity imposes operational or functional limitations.

Transportation and Materials

Considerable interest was expressed in the subject of aeronautics, either as a complementary element of a Space pavilion or as a separate exhibit by itself. An aeronautics display could be a prototype for showcasing the process of technological development from creative

insight to practical application. Progress over time in aeronautics--in wing design, engines, cockpit instrumentation, collision avoidance systems, etc.--would demonstrate man's continuing search for better, safer, more efficient transportation technologies. Ideas presented for possible integration into the Transportation pavilion were the use of the Global Positioning System (GPS) to determine the position of a car, collision avoidance radar to warn drivers of potential hazards, and heads-up display of speed, mileage, and status data. With regard to transportation infrastructures, it was suggested that the Ride Quality Meter developed by NASA would be beneficial in measuring and improving ride quality of all people movers at Epcot Center, the Magic Kingdom, and Walt Disney World. These meters measure the effects of noise and vibration and will identify the axis contributing to any ride discomfort. The meter may also be useful in the improved design of new people movers.

III. TECHNOLOGY DISPLAY CONCEPTS

BIOMEDICAL

- Mannequin for Implantable Biomedical Devices
- Life and Health Pavilion
- Preventive Medicine
- Space Technology is Today's Hospital
- Hospital of the Future
- Laser Speech Display
- Cooling Garment for Individuals Wearing Animal Costumes
- The Land Enhancements

Title: Mannequin for Implantable Biomedical Devices

Relevant Show Area/
Infrastructure: Biomedical

Concept: Over the past 20 years there has been remarkable progress in the development of implantable devices that replace the function of diseased organs or joints. Examples of such devices are: artificial heart, implantable insulin pump, cochlear implant, artificial joints (hip, knee, finger joints), prosthetic urinary sphincter, penile implant, vascular grafts, neurostimulators, automated implantable defibrillators. Aerospace technology has been used in several of these devices.

A transparent, life-size mannequin with all of these implants displayed would be an impressive demonstration of how sophisticated technologies have made possible the replacement of damaged or worn-out parts of the body. It is important to point out that these artificial organs have prevented severe disability and in some instances death. To learn about the individual devices, perhaps phones could be placed around the mannequin with push buttons for each of the devices. When the artificial heart button is pushed, a tape describing the device's function, technology and history of development could be played. It might be interesting to include a discussion or display on future devices. Devices currently under investigation include artificial blood, artificial lungs, kidneys.

Author: Doris J. Rouse
Technology Applications Team
P.O. Box 12194
Research Triangle Institute
Research Triangle Park, NC 27709
(919) 541-6980

Title: Life and Health Pavilion

Relevant Show Area/
Infrastructure: Biomedical

Concept: A life and health pavilion containing the following elements is suggested:

1. Highlight the most important NASA Technology Utilization spinoffs to the health field for both ongoing and completed projects. An example is "Multispectral Analysis of Magnetic Resonance Imaging."

2. Showcase leading edge technologies applied to prevention (fitness, sports medicine, biomechanics, nutrition, for example), detection, and treatment of all major diseases and health problems.

3. Conduct actual medical research and development on site in the public view (NASA Life Sciences Shuttle/Space Station experiment ground test beds for example). Involve the public in prototype testing of new devices (advanced hearing aids and wheelchairs for example).

4. Conduct high-tech screening for appropriate diseases on site.

5. Host international symposiums on specific health disciplines at the pavilion. Conduct ongoing public education/awareness (American Cancer Society booth for example).

Author: Robert L. Butterfield
PT-TPO-A
John F. Kennedy Space Center
(305) 867-3017

Disney Coordinator for Working Group: Jerry Aldrich/Lou Kompare

Suggested Sponsor: A consortium consisting of major health organizations and companies, NASA, NIH

Title: Preventive Medicine

Relevant Show Area/
Infrastructure: Biomedical

Concept: Exhibits could be developed that would display the theme of preventive medicine. This topic is not within my area of expertise, but several individuals within NASA have knowledge in this area. Examples of exhibits are:

1. Telemetry equipment for cardiovascular, temperature, etc. monitoring.

2. Health benefits derived from exercise.

3. Predictive tools through data-based management systems used for diagnostic purposes.

Author: William M. Knott
MD-ENV
John F. Kennedy Space Center
(305) 867-3152

Contact's Name: Dr. Wyckliffe Hoffler, NASA/KSC

Telephone Number: (305) 867-2964

Title: Space Technology is Today's Hospital

Relevant Show Area/
Infrastructure: Biomedical

Concept: People would either ride or walk through a simulated hospital that incorporates the many spinoffs from the space program in the medical profession. There are hundreds of these ranging from cleanroom technology, which is used in operating rooms to protect the patient from infection, to cryogenic probes used in brain surgery. Some other ideas would be sensors used on patients (similar to inflight instrumentation on astronauts), which provide a continuous flow of data to a monitor that alerts nurses or doctors of any changes in condition; rechargeable pacemakers, tiny transmitters that can be swallowed like pills to monitor internal temperature, etc.; portable blood analysis machines based on technology from the Mars lander, and a device for cataract surgery.

This could be supplemented with displays on manufacturing of pharmaceuticals if expansion of this area is desired.

Author: Hugh W. Harris
PA-PIB
John F. Kennedy Space Center
(305) 867-2468

Disney Coordinator for Working Group: John Zovich

Suggested Sponsor: McDonnell Douglas, Johnson & Johnson, Humana Hospital

Title: Hospital of the Future

Relevant Show Area/
Infrastructure: Biomedical

Concept: A showcase of new hardware to help in health care of the future could include laser aided operations, better bio-monitors, and within-body transplants to improve the quality of life for persons needing regular medication. The U.S. population, which is getting older on the average, is very interested in these types of hardware that NASA is helping to develop.

Author: Harry O. Erwin
EE6
Lyndon B. Johnson Space Center
(713) 483-3660

Disney Coordinator for Working Group: Dick Fox

Title: Laser Speech Display

Relevant Show Area/
Infrastructure: Biomedical

Concept: Instead of dealing with canned patterns in the laser writer, use a microphone and a speaker system to allow the visitor to "see" his words in optical format. This type of demonstration could open up the imagination to ways of helping the deaf to "hear" through sight or to develop speech recognition devices to identify people by speech patterns and to allow machines to understand verbal commands.

Author: Harry O. Erwin
EE6
Lyndon B. Johnson Space Center
(713) 483-3660

Disney Coordinator for Working Group: Dick Fox

Title: Cooling Garment for Individuals Wearing Animal Costumes

Relevant Show Area/
Infrastructure: Biomedical

Concept: NASA cooling garment technology would allow a person to remain cool for a couple of hours without overheating.

Author: Chuck Kubokawa
D.O.
Ames Research Center
(415) 694-5554

Disney Coordinator for Working Group: Ben Schwegler

Suggested Sponsor: Ames Research Center

Contact's Name: Ms. Pat Kirk

Title: The Land Enhancements

Relevant Show Area/
Infrastructure: Biomedical

Concept: The following modifications would enhance the land:

1. Food safety and inspection: Add displays of advanced food safety and inspection technologies. Detection of contaminants and screening of livestock are important examples.

2. Nutrition: Illustrate, using high technology such as computer graphics and image processing, the benefits of proper nutrition to health (fiber reducing colon cancer risk for example).

Author: Robert L. Butterfield
PT-TPO-A
John F. Kennedy Space Center
(305) 867-3017

Disney Coordinator for Working Group: Jerry Aldrich/Lou Kompare

Suggested Sponsor: USDA, NASA, major food and health organizations and companies

COMPUTERS

- Public Involvement
- Computers
- Journey Into Imagination Enhancement
- Library of the Future
- Information Science
- Crystal Storage of Information
- Laser Control Using a Home Computer
- CAD-CAM Demonstration

Title: Public Involvement

Relevant Show Area/
Infrastructure: Computers

Concept: Provide more manned exhibits with direct interaction (keyboards, joysticks, CRT's, etc.). Application area examples include computer graphics, robotics, personal computers, image processing, and lasers.

Author: Robert L. Butterfield
PT-TPO-A
John F. Kennedy Space Center
(305) 867-3017

Disney Coordinator for Working Group: Jerry Aldrich/Lou Kompare

Suggested Sponsor: Major high technology companies, universities, NASA.

Title: Computers

Relevant Show Area/
Infrastructure: Computers

Concept: It is all but impossible to build and fly air or space crafts without the help of computers. Through engaging visual images and friendly interactive units, I recommend a display (exhibit) that will illustrate these aerospace applications in very basic terms by explaining what a digital computer is that allows it to do so much.

Author: Ray L. Gilbert
IU
NASA Headquarters
(202) 453-8421

Title: Journey Into Imagination Enhancement

Relevant Show Area/
Infrastructure: Computers

Concept: The following modifications would enhance the Journey Into Imagination:

1. Computer graphics: Upgrade "The Image Works" computer graphics displays to state-of-the-art technology. Solids modeling and computer vision are important examples.

2. Image processing: Add advanced image processing techniques to "The Image Works" displays. The most powerful techniques are image enhancement and image classification. Important applications are medical research, remote sensing of Earth resources and nondestructive evaluation.

Author: Robert L. Butterfield
PT-TPO-A
John F. Kennedy Space Center
(305) 867-3017

Disney Coordinator for Working Group: Jerry Aldrich/Lou Kompare

Suggested Sponsor: Major computer graphics and image processing companies, NASA.

Title: Library of the Future

Relevant Show Area/
Infrastructure: Computers

Concept: The excellent World Key Information system in use at Epcot is a perfect base on which this type of exhibit can be built. If one element in our life is going to change dramatically in the next few decades, it is the way we handle information. The concept of electronic mail, wired city, and work at home will become commonplace. How will we use all the information available to us? The library of the future will show a glimpse of what is to come. This exhibit can start out conservatively and develop in time to a truly "mind blowing" experience.

For example, a first step may be to encode the information from a typical Almanac and use a user-friendly look-up method to extract desired information. The method of nesting information in different categories can also be shown. For example, one can build a list of all cities with populations greater than 100,000; then a list of all cities with major football teams; then cross-link the two to develop a list of cities of population >100,000 and having a major football team. Other such data manipulation will allow the visitor to see how information can be searched.

The exhibit will show a stack of books--many thousands of pages--and the optical disk that stores all the information in so small a space. Could anyone scan the myriad of pages to find the proverbial needle in the haystack? The new information system can do it accurately, quickly, and in any format. The audience will see tomorrow today and carry away a new appreciation for the information explosion and its management.

Author: Joseph S. Heyman
MS 231
NASA Langley Research Center, Hampton, VA 23665
(804) 865-3036

Disney Coordinator for Working Group: John F. Zovich

Title: Information Science

Relevant Show Area/
Infrastructure: Computers

Concept: Information Explosion
Information Processing and Display
Need/Use of Artificial Intelligence (Expert Systems, Data Base Tech.)
How the Brain Works/Cognition Reasoning/Inferencing "Creativity"

Author: Ray Hartenstein
735
Goddard Space Flight Center
(301) 344-5659

Disney Coordinator for Working Group: Dick Fox

Title: Crystal Storage of Information

Relevant Show Area/
Infrastructure: Computers

Concept: Most of today's information is stored on magnetic tape or disks or in film form. The information of tomorrow will be stored in photo-refractive crystals. These devices are capable of storing data in a much more compact format than is now possible. Today's technology will allow the showing of a short "moire" whose entire images are stored as information in crystals. This would give visitors a look at data storage and use in tomorrow's homes, schools, and factories.

Author: Harry O. Erwin
EE6
Lyndon B. Johnson Space Center
(713) 483-3660

Disney Coordinator for Working Group: Dick Fox

Title: Laser Control Using a Home Computer

Relevant Show Area/
Infrastructure: Computers

Concept: Using simple home computers allows visitors to control and cause a laser radar to move and point. This type of demonstration gives insight into machine control by computer and not just number crunching. Of particular interest to people is using this type of setup with a CO_2 laser to pop a balloon or light a match or cut a piece of cloth. This can be done quite safely and with enough showmanship to interest large crowds of people.

Author: Harry O. Erwin
EE6
Lyndon B. Johnson Space Center
(713) 483-3660

Disney Coordinator for Working Group: Dick Fox

Title: CAD-CAM Demonstration

Relevant Show Area/
Infrastructure: Computers

Concept: Using a Computer Aided Design and Computer Aided manufacturing set-up, allow visitors to design and show an object and then obtain a copy as a souvenir of the occasion. One particular type of computer aided design would allow the visitor to design his house by making choices and getting lay-out help from the computer.

Author: Harry O. Erwin
EE6
Lyndon B. Johnson Space Center
(713) 483-3660

Disney Coordinator for Working Group: Dick Fox

ENERGY

- Energy
- 11-MW Modular Phosphoric Acid Utility Fuel Cell
- Redox Energy Storage System
- Energy Conservation Through Voltage Reduction
- An Exhibit on Induction Motors in the Energy Pavilion
- Heliostat--Why?
- Alternate Energy Displays
- Energy Pavilion Remote Sensing
- Solar Energy Displays
- Sun Furnace
- Heat Pipe Application for Dehumidification in Air Conditioners

Title: Energy

Relevant Show Area/
Infrastructure: Energy

Concept: This would be suitable as a demonstration, possibly in conjunction with the Energy Pavilion. It could take the form of a major stand-alone operating demonstration or a smaller model illustrating concept.

The concept is a self-contained energy system using solar energy and water and producing either (or both) fuel (hydrogen) or electricity. Electricity produced by photovoltaic cells is used to power a water electrolysis system which produces hydrogen and oxygen gases. These gases can be stored and used in various ways. The hydrogen can be burned as a fuel for heating or cooling or operating internal combustion engines, or the gases can be used together in a fuel cell to produce electricity for local use or for sale to the power company.

Although this concept is not considered to be economically feasible at this time, the technologies are available and have been demonstrated in various NASA programs.

Potential sponsors would include Teledyne, energy systems that produce electrolyzers, and PV suppliers.

Author: Reed Barnett
PT-TPO-A
John F. Kennedy Space Center
(305) 867-3017 (FTS 823-3017)

Title: 11-MW Modular Phosphoric Acid Utility Fuel Cell

Relevant Show Area/
Infrastructure: Energy

Concept: Phosphoric acid fuel cells are an outgrowth of fuel cells developed for the manned space program in the 1960's. Over the intervening period, a 40-kW onsite fuel cell power plant has been readied for field testing. The Reedy Creek utility has such a unit almost ready for startup. A parallel development of modular electric utility generators began in 1971. A 1-MW pilot power plant was tested in 1977, a larger scale 4.8-MW unit was installed in New York for testing, and a demonstration plant ran in Tokyo last year. At present, a very large area (10-ft^2) cell has been developed capable of operating at higher pressures and temperatures. It is just now ready to enter a commercial development cycle culminating in an 11-MW modular power plant ready for delivery in early 1987 that will be cost competitive and will operate on natural gas. Such a power plant uses two-phase water cooling and would be adaptable for cogeneration. It is silent and has minimum impact on the air environment. Reedy Creek is investigating replacement of its gas turbine generation capacity over the next few years. The 11-MW utility fuel cell may be an important alternative. Additional information on this concept is available from:

Doris J. Rouse
Technology Applications Team
Research Triangle Institute
P.O. Box 12194
Research Triangle Park, NC 27707.

Author: J. Stuart Fordyce, Ph.D.
5000, M.S. 3-5
NASA Lewis Research Center
(216) 433-4000, ext. 729

Disney Coordinator for Working Group: Frank L. Jones--Reedy Creek Utility
Harvey C. (Tom) Jones--WED Enterprises

Suggested Sponsor: United Technology Corporation, Power Systems Division, South Windsor, CT

Contact's Name: Charles Cannon

Telephone Number: (203) 727-2220

Title: Redox Energy Storage System

Relevant Show Area/
Infrastructure: Energy

Concept: The Disney World/Epcot--Reedy Creek Utility System needs peak shaving capability. No suitable storage systems are presently commercially available. Over the past 10 years NASA Lewis, in cooperation with ERDA/DOE, has developed a cost-effective all-liquid electrochemical bulk electrical energy storage system suitable for utility application. It is a classic "flow" battery utilizing iron and chromium chloride solution reactants in stacks of cells to achieve the desired voltage level. Significant scaleup and system level evaluation has been carried out as well as detailed cost analyses. NASA's basic patents have been licensed under exclusivity arrangements to Sohio. This company is conducting extensive work to assess its commercial potential. A full pilot plant design should be completed within a year. NASA's in-house work verified 80 ma/cm^2 current density capability in 1-ft^2 cells and stacks at an overall energy efficiency of >80 percent. Several cost studies carried out independently indicate a system cost of about $75/kWh, making it cost competitive for typical 5-h-per-day utility load-leveling applications. Further details are contained in the Report, "NASA Redox Storage System Development Project, Final Report," DOE/NASA/12726-24, NASA TM-83677 (attached), October 1984.

Author: J. Stuart Fordyce, Ph.D.
5000; M.S. 3-5
NASA Lewis Research Center
(216) 433-4000, ext. 729

Disney Coordinator for Working Group: Frank L. Jones--Buena Vista, FL
Harvey C. (Tom) Jones--Glendale, CA

Suggested Sponsor: Standard Oil Company of Ohio (SOHIO), Warrensville R&D Center

Contact's Name: Mr. Herb Knudsen

Telephone Number: (216) 575-4629

Title: Energy Conservation Through Voltage Reduction

Relevant Show Area/
Infrastructure: Energy

Concept: The May 21, 1979, issue of Energy User News reported that in 1978, California utilities voluntarily lowered their distribution voltage 5 percent over 95 percent of their grid. They saved 1 billion kilowatt hours of energy, saved their customers $48 million in reduced utility bills (at 1978 power rates) and received no complaints of low voltage. Since Disney World has a degree of control over their distribution voltage they should investigate the possibility of maintaining their voltage at the lowest practical level. This is determined by the nameplate voltage rating on induction motors, which should be satisfied. Lightbulbs would last longer, reducing maintenance costs, with an acceptable decrease in intensity. The speed of induction motors would be unaffected. They would draw less current, waste less power, resulting in cooler operation and longer life. Motors and lighting consume most of the energy in a typical distribution system. The power consumed by certain types of lighting would be reduced by the square of the voltage reduction. T-frame induction motors consume 8 percent more energy with a 15-percent overvoltage (typically, a 220-volt motor operating on 252 volts). Assuming a typical Disney World load of 40 megawatts, 12 hours daily at 5 cents per kilowatt hour, each percent saved amounts to approximately $100,000 annually. This suggests that it may be cost effective to invest in voltage regulation equipment to maintain the absolute minimum voltage.

Author: Frank J. Nola
EB24
Marshall Space Flight Center
(205) 453-4255

Disney Coordinator for Working Group: Tom Jones

Title: An Exhibit on Induction Motors in the Energy Pavilion

Relevant Show Area/
Infrastructure: Energy

Concept: According to studies by A. D. Little Corporation, ac induction motors consume over half the electrical energy generated in the United States. There are more than 50 million (1/6 hp and larger) built each year and nearly a billion in use each day in homes and industry. They consume 1/3 more energy than automobiles, amounting to 7 to 8 million barrels of oil equivalent daily. They inherently waste power within the motor and in the distribution system when supplied with a voltage in excess of that required by the load. Unlike the dc motor, which changes its speed and back emf with load or voltage to regulate current flow, the ac motor is a constant speed machine. Excess voltage causes an excess of current which wastes energy. There are two methods of reducing this waste; build the motors larger and more efficient, and/or use the NASA-developed power factor controller (PFC). Each percent saved amounts to 80,000 barrels of oil equivalent daily.

The NASA PFC is an electronic device that senses the motor load and regulates the voltage accordingly to minimize current and wasted power. Lightly loaded motors often show a 40 to 50 percent reduction in wasted power that is best demonstrated by feeling the difference in motor temperature. Good examples of a demonstration are vacuum pumps and escalators. A typically loaded escalator often shows a 30 percent reduction in power, and vacuum pumps as much as 40 percent.

With respect to the DW infrastructure, it is our understanding that the PFC has been tested on certain rides at Disneyland, but we do not have official results. It should especially be considered in those applications where solid state motor starters are beneficial. This includes multiple start/stopping for load shedding and reduced voltage, soft starting to prevent shock loading on belts, gears, and loads due to high starting torques. Most vendors offer the energy-saving feature of the PFC at no additional cost.

Author: Frank J. Nola
EB24
Marshall Space Flight Center
(205) 453-4255

Disney Coordinator for Working Group: Tom Jones

Title: Heliostat--Why?

Relevant Show Area/
Infrastructure: Energy

Concept: Exxon and others have made a point of the sun as the source of energy, so show the sun. A heliostat would track the sun and with a straightforward lens design, back project a solar image which people could walk up to and touch. First method would be in white light, however, best would be Halpha (6563A) which would show real-time movement. This image could also be video-taped for transmission to other locations.

Author: Ken Cashion
HA40, Building 1100, ERL
National Space Technology Laboratories
(601) 688-1930

Disney Coordinator for Working Group: Jerry Aldrich

Title: Alternate Energy Displays

Relevant Show Area/
Infrastructure: Energy

Concept: Displays which illustrate concepts like wind farms, with different types of wind power generators, and power generation from oceans. These are quite futuristic. Wind farms are already making it. OTEC systems are in advanced concept R&D and prototype development stages.

Author: Ross McCluney (through Reid Barnett, KSC)
Florida Solar Energy Center
(305)783-0300

Disney Coordinator for Working Group: Tom Jones

Title: Energy Pavilion Remote Sensing

Relevant Show Area/Infrastructure: Energy

Concept: Exxon and others make a point that the sun is the source of energy but no one showed the sun in real-time. The visitor should see the sun as an active sphere not a bright spot. Solar activity represents the most catastrophic, reoccurring event man can routinely observe. (A solar flare releases energy at a rate of 30 hydrogen bombs exploding over a 30-minute period.) Sunspots are earth-size and affect our weather, climate, atmosphere, radio communications, plant growth, etc. Man is dependent on the sun and he is sun-ignorant.

Two methods of displaying the sun are proposed:

1. Heliostat to track the sun and reflect the white-light into a straight-forward stationary lens system, thereby presenting a large solar image to a rear projection screen. The sunspots (when present) would be visible on the screen, as well as the edge darkening showing the sun to be sphereroid.

2. An H-alpha telescope to track the sun and pass the light through a narrow (approximately 0.5 angstrom bandpass) filter with the center of the bandpass at 6563 angstroms. Additional lenses behind the filter would project the image onto a TV camera. The H-alpha filter system could be part of the heliostat, thereby eliminating the need of a tracking scope. This video image could be transmitted to TV monitors in a Kiosk. Photographs and other solar information would complete the display. The sun is very dynamic at this wavelength and rotates as well; therefore, any image description would need to be recorded every two or three days. (This would be easy to do. A recorded telephone message from a solar observatory would be excellent).

Author: Kenneth D. Cashion
HA41, Building 1100, ERL
National Space Technology Laboratories
(601) 688-1930

Disney Coordinator for Working Group: Jerry Aldrich

Suggested Sponsor: Heliostats--TBD

Telescope, Lenses, and Mount--Bausch & Lomb, 2828 E. Foothill Blvd., Pasedena, CA 91107, (213) 577-1500.

Celestron International, P.O. Box 3578-BZA, 2825 Columbia St., Torrance, CA, (213) 328-9560.

Filter--Del Woods, P.O. Box 1290, Pomona, CA 91769, (714) 591-4673.

Title: Solar Energy Displays

Relevant Show Area/
Infrastructure: Energy

Concept: Solar energy is one of the oldest known sources. Many methods have been tried in the past, but did not quite make it economically. Therefore, it is difficult to say anything about their future widespread use.

However, certain semiconductor-based devices are quite likely to make it in the future. Besides solar cells, I have read about small solar antennas that absorb a wide spectrum of wavelengths and convert sunlight into electricity more effectively. These are still in the research stages. Perhaps more information is available from SERI. Some models to display concept would be great!

Author: Ross McCluney (through Reid Barnett)
Florida Solar Energy Center
(305)783-0300

Disney Coordinator for Working Group: Tom Jones

Title: Sun Furnace

Relevant Show Area/
Infrastructure: Energy

Concept: Using small solar collectors and fiber-optics bundles a solar furnace for melting materials in a super clean environment of no contamination can be demonstrated. The fibers can bring the energy from the roof of one of the buildings to an exhibit area. This device can also be used to give people a safe view of our sun and to start thoughts of how important the sun is in our everyday lives. This type of device could also be used in the land exhibit to show plants grown on fiber optics supplied sunlight. The plants movement toward the light should be interesting.

Author: Harry O. Erwin
EE6
Lyndon B. Johnson Space Center
(713) 483-3660

Disney Coordinator for Working Group: Dick Fox

Title: Heat Pipe Application for Dehumidification in Air Conditioners

Relevant Show Area/
Infrastructure: Energy

Concept: A KSC technology utilization project is developing the application of heat pipes for use in conventional vapor compression air conditioners for increased dehumidification capabilities in high humidity environments where conventional systems are inadequate (e.g., Experimental House-Land Pavilion). Any application where humidity imposes an additional operation requirement or functional problem is a candidate for this system. A system could be installed as part of the infrastructure in any number of facilities or a demonstration/display system could be set up to show the technology.

The NASA project could probably be instrumental in providing hardware or displays for the proper installation. Also we could provide technical assistance in planning, installation and monitoring the system. An installation at EPCOT could be planned in such a way that it provides operational data of value in demonstrating feasibility--for which NASA could help support through the TU project.

There should be a cost benefit to EPCOT in system operation.

Author: Reed Barnett
PT-TPO-A
John F. Kennedy Space Center
(305) 867-3017 823-3017 (FTS)

Disney Coordinator for Working Group: Frank Jones (Energy)

Suggested Sponsor: NASA, DOE, Florida Solar Energy Center, Dink Co., Carrier Corp. (all involved in the NASA project)

GLOBAL HABITABILITY

- Terrestrium
- The Invisible Menace
- Global Habitability: Earth Environment and Remote Sensing
- Global Habitability

Title: Terrestrium: A terrestrial planetarium facility to study global habitability by modeling the processes of weather, climate, and global ecosystems on the surface of the earth

Relevant Show Area/ Infrastructure: Global Habitability

Concept: This proposal for a new space pavilion, in an expanded area of Walt Disney World's "Future World" at EPCOT Center, could be called a terrestrium--a participating terrestrial planetarium. It would be designed to provide an expanding capability for near real-time simulations of the natural processes that will determine the future habitability of the Earth. It would be a research facility, not a museum. The pavilion would be in the form of a 30 story globe of electronic colored picture elements. A major objective would be to develop digital models for lighting these pixels, so as to display current, future, and past images of the land cover and weather patterns on Earth. A second 100-foot-diameter globe of more densely spaced pixels would be in the interior. This interior sphere would again be electronically illuminated so as to provide a display for simulating the surfaces of the Earth and other planets. Emphasis for the use of both the interior and exterior globes of this space pavilion would be on projective modeling of the global and planetary processes of weather and climate, change in biological ecosystems, and in geologically meaningful domains, such as watersheds.

This terrestrium would provide:

- A physically visible focus of a beautiful Earth for a new section and community at Future World.
- A center-of-excellence for laboratories for visiting research professionals studying global habitability.
- A selection of exterior rides around the planet to simulate a real trip by a space shuttle to space stations and interior rides among the orbiting satellites.
- News centers for 24-hour coverage of the latest satellite acquired imagery and its integrated impact, especially for dedicated cable TV.
- Movie animation facilities to prepare simulations of visits to known planets and satellites and to create illusions of other possible planets in the universe.
- Theaters for viewing various sections of the interior globe which can be electronically rotated by changing the pixel colors and passing satellites.
- Interior rides between the globes for roller-coaster-type approaches to and away from the planets.

Title: Terrestrium: A terrestrial planetarium facility to study global habitability by modeling the processes of weather, climate, and global ecosystems on the surface of the earth

Concept:

- Tours of one of the most advanced computer simulation capabilities in the world.
- Hundreds of small group interactive computer work stations for accessing and interpreting images of any area of the world.
- A national global and planetary archive of remotely sensed satellite imagery from space probes for use in building the retrospective and projective simulations.
- A national crisis center for studying the impact of short-term environmental episodic events.
- An international center for world conferences.

A facility, such as this terrestrium, for the digital simulation of activity on our globe in both a real and 3-D simulated environment would provide a unique view into the infinite number of processes that will be the challenge of coming generations of scientists. The data base for this concept excesses or could be created over the next few years. Sources of data in weather satellites already provide information on the formation and movement of water in the form of clouds and storms. Other sensors could provide images of the movement of water vapor. These same NOAA satellites with sensors, such as the 4-5 band AVHRR, have already provided the first global representations of the distribution of biomass and vegetation types. These could provide the base for color views of the world in high or low illumination with overlain patterns of clouds taken in real time but played back in various ways to provide a sense of change with time. Since no one has had a facility of this scale to do this, we have little idea what we will see. One important aspect of the electronic pixels is to be able to change the spatial size of the displays to come in for close-up looks with images from the 4- and 7-band MSS and TM sensors on the Landsat satellites. There is no archive of clear imagery of the whole world, or even in the United States, that can be digitally accessed, displayed, and modeled with other sources of geographic information so that we can better understand our world. This is a game anyone can enjoy, not just scientific-type people. It is real and different. It builds on the premise that reality can be stranger and more exciting than fiction. Clear imagery from TM and MSS sensors could be collected on a seasonal and global basis in a manner of 1 year. Along with the daily AVHRR satellite data at 1-4 km spatial resolution, this 30-80 m resolution data would provide the initial global data base that makes this terrestrium concept feasible. The initial displays might involve a subset or combination of al. the bands such as "brightness" and "greenness" spectral transforms for deriving and

Title: Terrestrium: A terrestrial planetarium facility to study global habitability by modeling the processes of weather, climate, and global ecosystems on the surface of the earth

Concept: modeling information on clouds, forests, crops, and urban boundaries. Other data sets could be added to develop a model of a local biome, including synethetic operative radar, and aircraft coverage. Scientific modeling might start on biological productivity and life support cycles such as:

- Global energy cycle and coupling of atmosphere and oceans
- Biogeochemical cycles of macronutrients and trace compounds
- Global hydrologic cycle
- Land surface inventory and dynamics
- Biological productivity on the land

This terrestrium could become a national, or international, resource of online imagery of all land areas of the world.

Sponsorship of this pavilion might come initially from a large movie production such as a new episode of Star Wars. This activity would then be replaced with semi-permanent activities such as 24-hour news broadcasting and visiting research laboratories and governmental crisis centers.

One reason for this idea is that there is a national need to take advantage of the explosive potential for modeling from the combined data gathering satellite systems and super computers. We are currently not collecting, or throwing away, more data than we are analyzing. We need a show. It is a bigger and more important game than most people realize. We need more people playing with these images. This space pavilion would be a living showcase. One would not have to worry about an obsolete projection of the future; it would be the future and it would constantly renew itself. Such a concept of a terrestrium to view the past, present, and future would create a vitality of its own with an emphasis on process rather than products, direction rather than positions. This is the way of the future.

Author: John L. Barker
623
Goddard Space Flight Center
(301) 344-8978 or -7282 (message)

Disney Coordinator for Working Group: Henry Robitaille and Andrew Schuerger

Implementation Cost Estimate: $200,000,000

Title: The Invisible Menace

Relevant Show Area/
Infrastructure: Global Habitability

Concept: The control of acid rain represents a major dilemma facing the world as we approach the 21st century. Sulphur dioxide (SO_2) emitted by industrial plants is the major contributor to acid rain, and various control strategies have recently been employed to reduce these emissions. Remote sensing technology is simultaneously emerging to economically monitor these abatement strategies. A most unique method for monitoring is utilized by the VISIPLUME system, which uses ultraviolet video techniques to "see" and accurately measure the otherwise invisible emissions of SO_2. An active display, in which actual SO_2 is emitted from model industrial stacks against a simulated UV background, would allow observers to identify pollution sources. Such an exhibit would clearly illustrate the elusive nature of the pollutant, and also show how advanced technology can be used to effectively monitor the progress in SO_2 abatement.

Additional Information on this concept is available from:

Doris J. Rouse
Technology Applications Team
Research Triangle Institute
P.O. Box 12194
Research Triangle Park, NC 27709

Author: Reginald J. Exton
MS 235A
NASA/Langley Research Center
(804) 865-2791

Disney Coordinator for Working Group: Henry Robitaille and Andrew Schuerger

Title: Global Habitability: Earth Environment and Remote Sensing

Relevant Show Area/
Infrastructure: Global Habitability

Concept: Key elements:

1. Remote sensing
2. Massive data management, storage, and integration
3. Earth from a new perspective
4. Social behavior/technology interaction
5. International appeal and need for mutual cooperation
6. Combines orbital-surface-subsurface measurements (therefore, new sensors and data integration)
7. Subelements displays include Resource Discovery and Management, implications for our global future; ("what if" type simulations to compress time/effects), orbital satellites; cross cultural understanding; full zoom-down to individual housetop level; use of current landsat imagery (X10 scaling of space station to spaceship Earth), weather and climate modeling and short/long term implications; geophysical modeling; visitor information center as integral part of pavilion.

Author: Dick Haines
LH
Ames Research Center
(415) 694-5719

Disney Coordinator for Working Group: Dick Fox

Relevant Show Area/
Infrastructure: Global Habitability

Concept: Global Habitability refers to a NASA new initiative related to an integrated, world-wide environmental monitoring program in which state-of-the-art aerospace technology will be used to study the outer space--atmospheric--earth surface--and undersea symbiosis.

The following design concepts and sketches are intended to serve only as preliminary discussion points for a large-scale public display such as is found at various theme parks in America today. Following are several general design criteria for a special attraction dealing with "Global Habitability."

1. Must accommodate from 25 to 35 people per minute in those attractions that are entertainment oriented and which permit self-locomotion.

2. Must accommodate from 300 to 400 people per hour (i.e., 5.8/min) in those attractions that are educative and which require group seating.

3. Must provide a natural and continuous people flow that complements the natural progression of ideas and visual imagery of the separate exhibitions within the pavilion.

4. Must present sensory stimulation in various sensory modes simultaneously. Visual, auditory, skin temperature, and proprioceptive impingement must occur simultaneously in harmony with the particular kind of entertainment and/or educational display present.

5. Must permit and encourage participant/viewer interaction with the display(s) being presented such as touch screen or response panel interface. In this way public reactions and a "town forum" vote on selected issues can be obtained quickly, automatically, and efficiently.

The Earth as One Habitat for all Mankind

A center atrium, entry area would provide the center focus of this pavilion. It would be entered from beneath using a tunnel with glass walls to illustrate deep underground scenes, mining operations, petroleum drilling, sub-surface erosion control, etc. The atrium would have several important functions. It would:

- Provide a time and place for people to adapt to the interior, quiet, semi-darkness of the building.
- Begin to introduce the basic theme of Global Habitability.
- Begin to permit individual self-choices to which subjects the viewer wants to experience first. Entry into all four theatres would be from this central entry atrium.
- Educate the viewer about how to use the "viewer interaction panel." These panels would be located throughout the pavilion with multi-lingual instructions.

Four Fixed Theatres in the Round each will hold from 150 to 200 people with automatic entry/exit doors (unattended): Mobile auditorium seating would rotate in 90 degree arc quardrants facing each of the four theatres with side partitions.

The circular, center atrium would become the staging area and entry areas into a single revolving auditorium. This auditorium would face outward toward the active display screen or glass window(s) of each respective theatre. These theme theatres would be:

Theatre One. "Earth's Space Environment"

Theatre Two. "Earth's Mantle of Air"

Theatre Three. "Earth's Crust"

Theatre Four. "Earth's Underseas"

The Computer of Tomorrow--The Challenge of Information Management

This display area would contain several smaller demonstrations of how electronic computers are now being used by NASA, NOAA, etc. Each of the separate viewer areas would emphasize different computer capabilities. For instance, their ability to collect, store, analyze, and display multidimensional data sets on fluid-dynamic topics such as the earth's atmospheric "bow wave" in the solar wind stream could be demonstrated. Other topical areas are listed below. Each of the sub-areas could be integrated into the larger theatres discussed above or could become a separate cluster.

Sub-Area One. "Ask the Computer Your Own Question." This interactive area would allow participants to use voice entry,

touch-screen, keyboard, and other computer interfaces to interrogate a super-smart computer on various topics of public interest. An important emphasis here would be to find out what is interesting to the general public. For example, are people at all concerned about local air pollution, regional air pollution, inter-state air pollution, international air pollution? Are people willing to change their personal behavior if it can be shown someone else's life can be improved thereby?

Sub-Area Two. "What if?" The participants could give a set of physical parameters to the computer to solve and display. Then a permanent take-home hard copy would be given to the participant. An emphasis here would be to find out how people structure problem-solving questions in the first place.

Sub-Area Three. "Building Team Work." In this area people would have to work together in teams of from two to ten to solve a computer-generated problem. The highly technological and scientific Global Habitability Program cannot succeed in the long-run without a corresponding participation of the peoples of the entire world in a team approach. This sub-area would introduce this concept. It would be tied into sub-area 1 and 2 to find out what really interests the man on the street.

It should be obvious that each of these sub-areas would become part of the data-gathering program of Global Habitability dealing with social, cultural, and psychological factors. Key questions having to do with what really motivates people to cooperate with each other could be raised here. Annual faculty fellowship programs with universities could be set up so as to permit these sub-areas and their computer-based capabilities to be used in actual research related to the planning and implementation of subsequent Global Habitability programs.

Sub Area Four. "Where Do You Live?" Here each participant would be able to point to a large format CRT with touchscreen capability to progressively narrow down in scale to his or her own state/country, city, city block, etc., using interactive video-disc and pre-stored imagery. One of the social-psychological objectives of this sub-area would be to find out whether people would like to move up to new regions or stay where they are. The computer-based displays could ask selected "what if" questions before, or during, the use of the touchscreen to see if regional working/living selections were changed because of the questions asked or assumptions raised.

Theatre Two. Earth's Mantle of Air

This theatre display would include a large enclosed atmospheric chamber in which the weather would be controlled and created before the viewer's eyes. A wide visual field auditorium holding from 250 to 400 people would face a glass wall separating them from the "weather chamber." All forms of water precipitation, electrical storms effects, high- and low-temperature effects, and high- and low-pressure effects would be presented under computer control.

During every show, one person from the audience (a child) would be selected to come forward and "create the weather" in some pre-selected, limited fashion, e.g., create a snow storm.

The design objective of this pavilion attraction would be to demonstrate how sensitive our weather patterns are to pollution and human interference. It would also be possible to show that weather is a truly global phenomenon which has significant impact on all of life.

Theatre Four. Earth's Underseas

In this theatre the audience would look through thick glass windows underwater at sea displays which emphasize (a) ocean floor life forms, (b) man's pollution, (c) living/working undersea, (d) the delicate symbiosis between the sea, air, and land and how one affects the other.

Computer simulations dealing with ocean diatoms and oxygen production could be displayed. An emphasis would be on the delicate interactions which exist between the ocean and atmosphere since each acts as a buffer (in the chemical sense).

Information Center

This area would be near the exit and would have available a wide variety of public information of a general and a specific nature. Free handouts, records, books, pamphlets, video tapes, video discs, movies, and audio tapes would be available at a cost that would just cover costs and a small profit.

Author: Richard F. Haines, Ph.D.
Aerospace Human Factors Research Division
Ames Research Center
Moffett Field, CA 94035

IMAGINATION

- What is Color?
- Breakthroughs
- The Process
- "I Have an Idea"--or How Do We Work Toward Tomorrow's Dreams Today--The Process of Innovation and Technology Application
- Invisible World

Title: What is Color?

Relevant Show Area/
Infrastructure: Imagination

Concept: A very exciting display can be set up showing how different colors of light add to produce another color. Using color filters and polarizers, a brilliant color image can be produced from a seemingly black and white picture. This type of hands-on experience will sharpen visitors' interest and knowledge of colors around them.

Author: Harry O. Erwin
EE6
Lyndon B. Johnson Space Center
(713) 483-3660

Disney Coordinator for Working Group: Dick Fox

Title: Breakthroughs

Relevant Show Area/
Infrastructure: Imagination

Concept: This exhibit would show how some of the past advances or breakthroughs in science have led to improvements in the quality of our lives today when compared with 50 to 100 years ago.

The exhibit would then survey the types (and specific items) of research going on today in laboratories around the world. The success of this research would then be extrapolated to show what it will mean to our future and that of our children and grandchildren.

The exhibit would also attempt to show what other breakthroughs in science and technology might mean . . . even if no research were presently underway . . . such as the ability to fly at the speed of light.

Some of the areas that might be addressed are artificial organs and artificial skin to rebuild the body; genetic engineering showing success in oil spill cleanup and other projects underway; fusion research; use of hydrogen in cars; solar cells for home electrical power; research aimed at lunar and Mars colonies, as well as orbiting space stations; and transportation research such as levitation of trains and other types of engines or components (ceramic engine blocks and composite materials, for instance).

The exhibit would have to be updated every year . . . but if taken a step further it could provide an excellent tool to the country for keeping track of the types of research being done worldwide.

Author: Hugh W. Harris
PA-PIB
John F. Kennedy Space Center
(305) 867-2468

Disney Coordinator for Working Group: John Zovich

Suggested Sponsor: Institute of Health, Bell Labs, IBM, Texas Instruments.

Title: The Process

Relevant Show Area/
Infrastructure: Imagination

Concept: How to use imagination, combined with technology, and ideas to create the world of tomorrow, i.e., to generate breakthroughs. Interactive design experiment. Imagineering: Have a question or need.

Author: Ray Hartenstein
735
Goddard Space Flight Center
(301) 344-5659

Disney Coordinator for Working Group: Dick Fox

Title: "I Have an Idea"--or How Do We Work Toward Tomorrow's Dreams Today--The Process of Innovation and Technology Application

Relevant Show Area/ Infrastructure: Imagination

Concept: The current Carousel of Progress (COP) is in need of a new display and sponsor. I suggest we showcase the concept of the "process" of Research and Development (R&D). In this effort, we can show how ideas move from Ah-Ha! stage to practicality. The specific technical area we work with is not as important as the overall concept of the process of getting from today's idea to tomorrow's product. As an example, I recommend that we use aeronautics as the first choice for COP. Following is one concept for the six pie-shaped theaters in the current COP building. Each of the stages has a right and left smaller rotating stage on the main rotating stage. One main theater is used for entrance/exit leaving, five for the "play."

Play #1: Show the balloon flights of the 1800's as the high technology of the day with the proud aero's stating "What more could anyone want?" One of the smaller side stages ends with the foolish bicycle boys (Wright Bros.) pulling kites and saying "I have an idea!" and gets down to work.

Play #2: Show the Wright Bros. innovative wind tunnels and the fruits of their hard labor--the first short flight. The play ends with "What more could anyone want?" and again on the side stage, we see researchers (perhaps the NACA cowling) saying as they look at test results "I have an idea!" and gets down to work.

Play #3: Show the major advances to prop flight up to about the period of the '50s (such as the DC-3) with Airline Co. using planes for routine transportation. Again, someone says "What more could anyone want?" As before, the side stage comes alive with the activity of more modern labs with an engineer saying "I have an idea!" holding a model of a jet.

Play #4: This stage shows the aircraft of the '60s-'70s (707, for example) and talks of all the improvements made over the past period. As before, the action dwells on the improvements made and says "What more could anyone want?" Side stage takes over in a more modern lab with some electronics but not computers and someone says "I have an idea!"

Play #5: Shows very modern aircraft, 747, 767, VTOLs, STOLs, SST, XB-70, etc., and tells of the newest advances--use of composites for energy savings (lower cost fares), advanced efficient engines with less noise and pollution, speed of new aircraft, etc., leads some to say "What more could anyone want?" Again on the

small stage a scientist looking at computer displays which are flashing advanced drawings of hypersonic vehicles or near space vehicles says "I have an idea!!!"

Another possible technology is the electronics industry with similar advances from stage to stage.

The same story could be told of medical advances.

Author: Joseph S. Heyman
MS 231
NASA Langley Research Center, Hampton, VA 23665
(804) 865-3036

Disney Coordinator for Working Group: John F. Zovich

Suggested Sponsor: Boeing or United

Title: Invisible World

Relevant Show Area/Infrastructure: Imagination

Concept: There are many wonderful and amazing things right in front of our eyes that we cannot see--even though we see them every day! In this display, we show how the world of measurement can let us see things we normally overlook. As an example, this exhibit could contain the "Hall of Small," the "Cast of Fast," and the "Unseeing Eye." I shall describe the concepts in some detail. In general, the exhibits would be best if "conducted" by a leader.

Hall of Small: In this exhibit, a variety of advanced projection microscopes will be available to see the variety of items below the limit of human vision. In particular, the display will showcase a scanning electron microscope with high depth of field and variation in magnification. The audience will see everyday invisible items as the "leader" zooms them into the visible.

Cast of Fast: The use of strobe illumination photography will be showcased here to allow the audience to see things that happen too fast for normal vision. Many of the exhibits can be derived from real-time motion pictures of fast events followed by very slow motion pictures of the same. For example, the pin popping a balloon, the bullet hitting a light bulb, and a drop of water hitting water can make quite a show. A recent book commemorating the brilliant work of Eggerton (of EGG fame) and his strobe light is a "catalogue" from which this exhibit may be built.

Invisible Eye: This exhibit will show how items look when viewed with different eyes. One such view will be with eyes sensitive to the infrared. The audience will see the temperature profile of a human face and learn how to "read" a false color temperature picture. In addition, the camera will show a comparison between two models of houses--one insulated, the other without insulation--to graphically show heat going "out the window." Other wavelengths will also be shown including the narrowband visible images of some familiar objects such as flowers. The exhibit will end with a look at the NASA Landsat satellite images and how they are used to identify quantitative ground information from remote satellites.

Author: Joseph S. Heyman
MS 231
NASA Langley Research Center, Hampton, VA 23665
(804) 865-3036

Disney Coordinator for Working Group: John F. Zovich

Suggested Sponsor: Hitachi, EGG (or General Radio), Inframetrics, respectively

INFRASTRUCTURE

- Weather Forecasting/Weather Warning
- Seismic Sensors for Perimeter Monitoring
- Recycling at Epcot
- Infrastructure

Title: Weather Forecasting/Weather Warning

Relevant Show Area/
Infrastructure: Infrastructure

Concept: There are three major programs currently underway at the Kennedy Space Center that could be of operational and display value to Epcot/Disney World. Through the NASA Technology Utilization Program, products developed at KSC to enable a safer, more effective operation in a hostile environment can be adapted to Epcot/ Disney World operations (remote terminal access to MIDDS). Through the use of additional graphic-smart terminals, Epcot visitors could access weather information for essentially any part of the world that may be of individual interest. This information could include synoptic data, forecast information, or instructional information regarding safety precautions relative to adverse weather conditions.

- Meteorological System Modernization Program (MSMP). KSC, together with Air Force Weather Group, has operated the Air Force Weather Forecast Facility to include a computerized meteorological data display acquisition system called MIDDS for Meteorological Interactive Data Display System. This updated system will interface with a new GOES Satellite ground station, digital radar (local and regional), nautical weather service data, and the local environmental data systems, which includes instruments to measure wind speed/ direction, temperature, pressure, humidity, electric fields, and lightning locations. The system will provide a variety of display options with overlay capability for both observed and forecast weather products to any user having access and appropriate hardware. The system was developed to do weather analysis so the capability to support research from historical data is available.

  This extensive climatological data gathering system will be used to feed a Weather Forecasting Expert System, currently in development, either in a manual mode through the weather forecaster or in an automatic mode through computer data systems interfaces. These data will be used by the expert system to make forecast recommendations. The subset goals of this project will be to evaluate the potential of expert systems technology to assist in local KSC weather forecasting, evaluate and recommend expert systems tools (software and hardware), develop a prototype expert system that can demonstrate the technology, test and enhance the prototype expert system, recommend and incorporate means for meteorological data input from existing and proposed data sources, and provice guidelines for future operational implementation and improvement of the

prototype system. This project is anticipated to last approximately 3 years from a planned start date sometime during the first quarter of CY 1985.

This Weather Forecasting Expert System project is one of three ongoing expert system development projects at Kennedy Space Center, the central goal of which are to develop an in-house NASA capability for developing expert systems to support the ground processing of space hardware. This in-house development capability will include trained NASA Knowledge Engineers, symbolic processing hardware, and expert system software development tools that can be used on a continuing basis in the future.

- Rocket Triggered Lightning Program. An interagency program to characterize lightning danger to aerospace vehicles and ground facilities with participants representing KSC, U.S. Air Force, FAA U.S. Navy, France (ONERA, GENG, CENS, and CNET), Universities of Florida and Arizona, (UF & UA), State University of New York at Albany (SUNYA), Electric Power Research Institute (EPRI), and Bell Laboratory. A 2-year effort that will use a ground-based instrumented rocket-triggered lightning site, remote research sites, and an instrumented aircraft. The overall objective of this program is the determination of current and electromagnetic fields received by an aerospace vehicle struck by lightning and comparing results with simultaneous current and electromagnetic field levels obtained at the KSC-triggered lightning site. Measurements will simultaneously be made at the KSC triggered lightning site to an Air Force-simulated fuselage (aluminum cylinder containing current and field sensors) KSC-Area Lightning Protection System concept, EPRI-power line, and a Bell Lab-aerial/buried communications line.

- Atmospheric Science Field Laboratory Demonstration Program. As a research facility the ASFL would use rocket triggering to create natural lightning in a laboratory setting, permitting accurate time-correlated measurement of pertinent data enabling in-depth studies. By allowing outside organizations to use this facility for their lightning studies, the KSC objectives are advanced in two ways. First the talent represented by the outside participants would significantly enhance the capability of the RTL to conduct meaningful research. Second, the knowledge and experience existing at KSC, the facilities provided by KSC, and the information obtained during the program would all be transferred to the users and would constitute a valuable technology transfer.

In addition, data from the extensive instrumentation and meteorological system provided to satisfy operational requirements would be available to researchers in a time-correlated fashion. This will enable individual researchers to focus on specific variables without having to pay the cost of the entire time correlated data system which exists primarily to support KSC operations.

A large number of organizations have experienced (or anticipated) serious problems related to semi-tropical, severe weather phenomena such as lightning and thunderstorms. This would include: (1) railroads and the transmission of lightning strikes over great distances along railroad tracks, (2) electric power companies and the effects of lightning on power transmission lines and equipment, (3) communication companies and the effect on communication equipment, (4) aircraft manufacturers and operators, (5) fuel and ordinance depots and handling areas, and (6) a wide range of industrial and manufacturing facilities. There is great concern about the effects of lightning in recreational areas used for boating, golfing, and other outside activities that attract large crowds of people. Representatives of most of the above activities have contacted KSC regarding lightning technology and have expressed interest in participating in an atmospheric sciences field laboratory at KSC if one were available.

Author: William Jafferis
SO
John F. Kennedy Space Center
(305) 867-3997

Title: Seismic Sensors for Perimeter Monitoring

Relevant Show Area/
Infrastructure: Infrastructure

Concept: Maintaining surveillance of Disneyland intrusions by poachers and trespassers automatically through signal transmission (SEISMIC) to receiver monitor.

Author: Chuck Kubokawa
D.O.
Ames Research Center
(415) 694-5554

Disney Coordinator for Working Group: Ben Schwegler

Suggested Sponsor: Ames Research Center

Contact's Name: Robert D. Lee

Title: Recycling at Epcot

Relevant Show Area/
Infrastructure: Infrastructure

Concept: The byproduct of the waste treatment plant recently closed down (glass fibers) could be used as insulation and possibly as growing medium for plants at the land pavilion. This and the many continuing uses of technology at the Epcot Center should be displayed or shown via large screen video to make people aware of the high technology behind the scenes at Epcot.

Author: Hugh W. Harris
PA-PIB
John F. Kennedy Space Center
(305) 867-2468

Disney Coordinator for Working Group: John Zovich

Title: Infrastructure

Relevant Show Area/
Infrastructure: Infrastructure

Concept: There are many technologies that have been developed at NASA to help the Agency with its critical problems of measurement. Some of those measurement areas are involved with safety, reliability, and maintainability--all areas that must be of interest to WED. I recommend that the NASA Technology Utilization managers be briefed on WED "real problems" to surface the infrastructure technology existing at NASA that can be transferred to WED.

An example of the type of technology that is available is the ultrasonic system developed to accurately preload critical fasteners and bolts. Bolts are conventionally loaded with torque. Unfortunately, torque measures both frictional effects as well as bolt elongation. In many situations, only 20 percent of the torque results in bolt loading: thus a 10-percent variation in friction can lead to a 50-percent preload error.

In practice, it is nearly impossible to achieve better than 20 percent accuracy with torque--and that is with critical handling of aircraft bolts! The NASA-developed system can achieve better than 1-percent preload accuracy and may be of importance in critical areas. An example for application would be for ride safety, expensive motor joints/bearings, critical heat transfer mounts, etc.

Other infrastructure items are NASTRAN for finite element analysis, advanced composites to reduce weight and increase strength of structural elements, advanced bonding technology for structures fabrication and repair, advanced nondestructive evaluation to check critical areas.

Author: Joseph S. Heyman
MS 231
NASA Langley Research Center, Hampton VA 23665
(804) 865-3036

Disney Coordinator for Working Group: John F. Zovich

LASERS

- "Lasers and Optics" Showcase
- Solar Optical Light
- Laser Vibration Sensor
- Laser and Chalk
- Optical Processing
- Laser Radar, Laser Docking System
- Holography Display
- Fiber Optics Encoders and Decoders
- Whole-World Paging
- IR Communications

Title: "Lasers and Optics" Showcase

Relevant Show Area/
Infrastructure: Lasers

Concept: A demonstration/education and interactive display showing:

1. Evolution of technology/background
2. Science/physics of technology covering:
   - Gas laser/HeNe, CO_2, etc.
   - Solid state/ruby, alexanderite, etc.
   - Semiconductor lasers/AlGaAs, InGaAsP, etc.
   - Associated optics/electronics
     - Prisms
     - Diffraction gratings
     - Lens/mirrors
   - Use of lasers in
     - Optical recording
     - Optical displays
     - Measurement (ranging, surveying, tracking)
     - Communications (include fiber optics--components, transceivers, etc.)
     - Chemistry
     - Semiconductor manufacture
     - Surgery/medicine
     - Holography
     - Sensors.

Author: Herbert D. Hendricks
MS 473
NASA Langley Research Center
(804) 865-3777

Disney Coordinator for Working Group: Jerry Aldrich and Lou Kompare

Title: Solar Optical Light

Relevant Show Area/
Infrastructure: Lasers

Concept:

1. Solar optical light interpretive sculpture Kinetic (SOLISK). A sculpture is designed and constructed that combines modern optical fabrication techniques with solar motion through the sky to produce varying patterns of light and color, projected onto surfaces of the sculpture and adjacent objects.

2. Solar optical light (SOL) clock and calendar. Using the Passive Optical Solar Tracker (POST) principle, Applied Optics 22, 3433 (1983), an image of the sun is projected onto a wall filled with markings indicating the hours of the day (solar time) and the days of the year. As the sun moves through the sky, its image traces out the times of day and the days of the year.

3. Future daylighting. A typical office or residence has large areas of very insulated window glass providing exceptional views of the outdoors for improved physical and psychological health and comfort. Energy costs are minimized by a combination of:

   - Insulated glazings that are as effective in blocking heat conduction as an opaque wall with R-15 insulation.
   - Automatically dimmed electric lighting, which is extremely efficient at converting electrical energy into illumination and which is reduced in illumination level and energy consumption as daylight illumination increases.
   - Space-age light pipes (recently developed in Canada) are used to channel daylight to where it is needed in interior locations not close to windows.
   - Automatic glare and radiant heat gain control, provided by a special glazing material which changes its radiant transmittance according to electrical signals applied to it by a small microcomputer which senses illumination levels and glare potential in the space.

Author: Ross McCluney (through Reid Barnett, KS)
Florida Solar Energy Center
(305)783-0300

Title: Laser Vibration Sensor

Relevant Show Area/
Infrastructure: Lasers

Concept: Using a laser doppler setup to measure microscopic motions, visitors can be shown ways of measuring vibrations of everything from an automobile engine to a huge beam for a building or bridge. Visitors can induce vibrations into different materials and see how important proper design is in preventing damaging undamped vibrations. A properly tuned engine can be distinguished from an improperly tuned one. Electric motors and machines can be balanced for better performance and longer lifetime.

Author: Harry O. Erwin
EE6
Lyndon B. Johnson Space Center
(713) 483-3660

Disney Coordinator for Working Group: Dick Fox

Title: Laser and Chalk

Relevant Show Area/
Infrastructure: Lasers

Action: Using a low power visible laser allows people to bang two chalk covered erasers together to make the beam visible. Even a low power eye-safe laser shows up vividly using this method.

Author: Harry O. Erwin
EE6
Lyndon B. Johnson Space Center
(713) 483-3660

Disney Coordinator for Working Group: Dick Fox

Title: Optical Processing

Relevant Show Area/
Infrastructure: Lasers

Concept: Using high technology light valves to form real time optical transforms, a robot can be made to recognize objects and scenes in much the same way that "Smart-One" recognizes sound patterns. A demonstration of this "Robotic Vision" is an important step into the automated factory of the future. A robot can be shown to recognize different objects from a group and to position it in the correct way to allow assembly. This eye-hand coordination optical processing demonstration goes a long way toward making robots real and not just toys. Other sensors could be demonstrated in addition to vision. Among these are touch, smell, and temperature sensing.

Author: Harry O. Erwin
EE6
Lyndon B. Johnson Space Center
(713) 483-3660

Disney Coordinator for Working Group: Dick Fox

Title: Laser Radar, Laser Docking System

Relevant Show Area/
Infrastructure: Lasers

Concept: The Laser Docking System is a visible laser beam which locks on and tracks a bicycle type reflector. This offers a very good demonstration of one of the laser technologies which could be displayed at EPCOT. The reflector could be moved by a robot or by a visitor and the laser would keep a beam of EYE-SAFE light centered on it. This technique is going to be used extensively in the factory of the future to calibrate and train the motions of robots.

Author: Harry O. Erwin
EE6
Lyndon B. Johnson Space Center
(713) 483-3660

Disney Coordinator for Working Group: Dick Fox

Title: Holography Display

Relevant Show Area/
Infrastructure: Lasers

Concept: Show the generation of a holographic exhibit by visible laser beams reflected from visible mirrors such that visitors can follow the process from object to image. As a display use a conference room, view across the table, see holographic persons across table, seated.

Additional information on this concept is available from:

Doris J. Rouse
Technology Applications Team
Research Triangle Institute
P.O. Box 12194
Research Triangle Park, NC 27709

Author:
Georg von Tiesenhausen
PS01
George C. Marshall Space Flight Center
(205) 453-2789; FTS 872-2789

Disney Coordinator for Working Group: Richard Fox

Title: Fiber Optics Encoders and Decoders

Relevant Show Area/
Infrastructure: Lasers

Concept: Passive fiber optics devices can be easily built that will transform seemingly random information into a clear image. Many forms of future communication transactions are going to need this encoding to ensure privacy and security. A simple encoder-decoder setup allowing the visitor to make order from an unordered image using fiber optics would give an exciting look at this technology of tomorrow.

Author: Harry O. Erwin
EE6
Lyndon B. Johnson Space Center
(713) 483-3660

Disney Coordinator for Working Group: Dick Fox

Title: Whole-World Paging

Relevant Show Area/
Infrastructure: Lasers

Concept: Through satellite link-up, demonstrate the ability to page someone anywhere on the globe. This can be shown using an electronic message board to allow messages to be sent and received from one part of the park to another.

Author: Harry O. Erwin
EE6
Lyndon B. Johnson Space Center
(713) 483-3660

Disney Coordinator for Working Group: Dick Fox

Title: IR Communications

Relevant Show Area/
Infrastructure: Lasers

Concept: Infra-red energy used to transfer data in an electrically noisy environment is a very useful and impressive technology. The areas where it could be effectively used at EPCOT are quite large. It could be used to demonstrate transmission of computer data to and from a mobile robot in the factory of the future. It could also be used to transmit vital function and biological data from a human to a large medical display board while the subject is undergoing physical exercises. A third area could be transmission of audio to moving cars with no slip connectors or cables.

Author: Harry O. Erwin
EE6
Lyndon B. Johnson Space Center
(713) 483-3660

Disney Coordinator for Working Group: Dick Fox

LIFESTYLE

- Lifestyles
- Discovery Arcade
- Home of Tomorrow

Title: Lifestyles

Relevant Show Area/
Infrastructure: Lifestyle

Concept: This exhibit would use computer graphics to allow families to see how their living accommodations may change in the future.

A touch-screen video terminal would allow the families to feed in the basic information about their family. The video screen would then show how a home and floor plan might change based on various assumptions . . . such as development of different materials such as composites. It might show how rooms could be added as a family grows and then sold to another family and the need for the additional space goes away. In this concept, a couple might buy a lot somewhere and build a home which can be expanded through the child rearing years and made smaller for greater efficiency for retirement. I would envision the computer graphics starting with line drawings of a floor plan, three dimensional line drawings and finally an artist's concept.

It would be good if various decisions could be put into the machine along the way so that the outcome is not always the same.

Some decisions might be type of career both husband and wife have or aspire to. This would determine location and whether or not they might work at home . . . tied by computer to the company headquarters. This might also determine what part of the country, urban, suburban, or rural area. Indicating hobbies and cultural interests could affect both location for home and type of home, i.e., workshops, artist studio, etc., and proximity to center for activities.

Finally, the design might well be influenced by advances in solar energy, use of fuel cells, ability to grow most of own food, and how self sufficient we learn to make our future dwellings.

Author: Hugh W. Harris
PA-PIB
John F. Kennedy Space Center
(305) 867-2468

Disney Coordinator for Working Group: John Zovich

Suggested Sponsor: Manufactured Homes Association

Title: Discovery Arcade

Relevant Show Area/
Infrastructure: Lifestyle

Concept: The Discovery Arcade will be a high technology entertainment/educational game room with video graphics to let the "player" see how choices affect the future of "the game." In reality, the game will reflect real choices that man has faced, is facing, or will face on "Spaceship Earth." Innovative graphics will make this group of games exciting to play as the player sees his/her own future evolve based on decisions made. The graphics will mix a proper fantasy element to the game yet will be serious enough that the intelligent player will see the parallel to his/her own reality. Some examples of the game types I'm thinking of are as follows:

1. Your dream house: The game starts off simply enough asking the player to design a dream house in his home state using design shapes from a pallet. The pallet can contain not only types of rooms, but also can adjust room size, add windows, doors, etc.

   The average person will ask for more than they can pay for--both initial cost and energy bills. Once the person says they are done with their design, the program will take over and show the cost of the "type" of building and the cost of heat/air conditioning and at current interest rates the monthly bills for same.

   The program will ask if they want to insulate (assuming they forgot to at first) and they can watch their energy bills go down. In a similar fashion, questions of triple-glazing windows, fewer windows, attic fan, shade trees, wind blocks, etc., will show their effect on energy. Finally, they will be asked if they want a smaller house and can see the effect on their cash flow.

2. Space colony master: Have at your command all the resources of your own small space world and see how your management decisions affect the future of your "world." This name could be the central core of many such games based each on one set of world limitations. For example, if the master uses nonrenewable resources faster than new research identifies different solutions to the specific resource need, the Space Colony fails. Such difficult problems of world food, overpopulation, pollution, energy "blackouts," "Space Colony" warming from overproduction of greenhouse effect gases, etc., can be shown in a humorous, nonthreatening game for "your Colony's future."

3. Design your city: similar to the other games.
4. Design your factory.
5. Design your car.
6. Plant your farm.
7. Design your airplane.
8. Design your highway/transportation system between cities.

Author: Joseph S. Heyman
MS 231
NASA Langley Research Center, Hampton, VA 23665
(804) 865-3036

Disney Coordinator for Working Group: John F. Zovich

Title: Home of Tomorrow

Relevant Show Area/
Infrastructure: Lifestyle

Concept: This can be displayed similar to the G.E. display in the Magic Kingdom where the audience is moved to five different scenes or with a two- to four-person car that moves through the center of rooms with displays on either side.

First scene will display the construction (a cross section of the wall, floor, ceiling rafters, and attic) to show the insulation and energy savings in the use of skylights; light pipes; windows and doors having thermal breaks; passive solar; insulation siding; floor, ceiling, and wall insulation; vapor barrier.

Second scene will show the mechanical, electrical, and computer systems used to run the environmental system (water-source heat pump, solar (photovoltaics) energy, and water reuse system).

Third scene will show the housewife doing her shopping (groceries, catalog-department stores) and paying her bills by computer in a modern kitchen while a robot is vacuuming the house.

Fourth scene is another room of the house where the husband, a salesman, is obtaining his orders and handling his accounts by computer and has eye-to-eye contact with his clients using a video communication system. The new communication techniques allow a person to work from his home.

Fifth scene can show, and the occupants explain, the other advances used in the house such as a solar-powered security system, flat conductor cable wiring, thermal window shutters that also provide additional security, seismic intruder detector, tornado warning device, and other new systems as they become available. At the exit of this exhibit, more details can be provided on the systems described, as well as a hands-on computer that can provide them the recommended insulation (in terms of R value) for their home by inputting their city and state.

Author: John Samos
MS 139A
NASA Langley Research Center
(804) 865-3281

Disney Coordinator for Working Group: John Zovich and Jon Sinkinson

OUTREACH/EDUCATION

- Communicore Enhancements
- "Factors of Ten" or "Macro to Micro"
- The Population Machine
- World Population Spire--(Art Work) Why?
- Measure Up!
- Behind the Scenes Tours
- EPCOT--Behind the Scenes
- Traveling Tech Train
- Yesterday's and Today's Composites
- History of Materials
- Effect of High Temperature Materials on Development of Energy Efficient Engines

Title: Communicore Enhancements

Relevant Show Area/
Infrastructure: Outreach/Education

Concept: The following modifications would enhance Communicore:

1. Both free sponsor-provided handouts and technical publications for purchase should be greatly increased throughout EPCOT. EPCOT Outreach and the Teachers' Center in Communicore should be at the heart of this thrust.
2. More smaller displays should be added, probably on a rotating basis, to insure that only leading edge technologies are showcased.

Author: Robert L. Butterfield
PT-TPO-A
John F. Kennedy Space Center
(305) 867-3017

Disney Coordinator for Working Group: Jerry Aldrich/Lou Kompare

Title: "Factors of Ten" or "Macro to Micro"

Relevant Show Area/
Infrastructure: Outreach/Education

Concept: This exhibit would fit in appropriately with the communicore form of entertainment/education since it cannot and should not be tailored to a single sponsor's product or technology line. The basic theme is to show the macro to micro scale of technology that mankind has to assimilate in order to move into the future. Mankind assimilates this information by developing the tools of the trade: (macro to micro) radio telescopes of the aceribo and the VLA (very large array) types and scientific satellites to listen to the galaxies and also to determine their compositions; optical telescopes including the planned for 400 and 600 inches and space probes for solar system viewing; earth satellites including Landsat, Seasat, etc., to measure the earth's parameters; computers and telecommunications to accommodate the demographics of the people; cat scanners, ultrasonics, etc., to map the human body and its physiological makeup; the scanning electron microscope to probe the mysteries of life and the integrated chip. The total demonstration can employ conventional video displays, 3-D video, hands-on working models, etc. The map that ties the technology demonstration together can be: sensing the photon, electron, electromagnetic waves, etc. The similarities of the galaxies/solar system to that of the molecule or atom; the development of the tools of the trade; the need to explore the universe and the atom.

Author: Al Jorolan
DL DED 1
John F. Kennedy Space Center
(305) 867-4856

Disney Coordinator for Working Group: John Zovich/Jon Sinkinson

Suggested Sponsor: Instrumentation Companies--Perkin-Elmer, Hewlett Packard, Beckman, etc.

Title: The Population Machine

Relevant Show Area/
Infrastructure: Outreach/Education

Concept: The simplistic electro-mechanical counter in the computer central complex offers no message except the population creep of the nation. Without a baseline year or rates of increase or decrease statistics etc., the numbers are meaningless. However, this primary counter can be used as the centerpiece of an educational experience that will show the observer how each increment of the counter directly and indirectly affects him or her. Ancillary counters would be connected to the primary in indicate for example:

1st group Natural Resources	Foodstuffs (tons) Total fresh water (gal), energy requirements (Btu's)
2nd group Services	Lawyers, Teachers Hospital beds, etc.
3rd group Mfg. products	Autos (per capita) Housing, computers, etc. (per capita)

Another group of counters can show age group shifts (21, 55, 70, etc., year olds.), life expectancy, social security recipients, etc.

And finally humerous counters--fast food restaurants/capita, video games, etc.

The entire readout makes sense if a reasonable baseline year is established (i.e., 1, 2, or 5 years) and incremented yearly.

Author: Al Jorolan
DL DED 1
John F. Kennedy Space Center
(305) 867-4856

Disney Coordinator for Working Group: John Zovich/Jon Sinkinson

Title: World Population Spire--(Art Work) Why?

Relevant Show Area/
Infrastructure: Outreach/Education

Concept: To demonstrate, in a simple, subtle manner, the need for technology. The population increase is the greatest driving force for technology. The spire is initially an art object. Large population numbers have no effect on the public because the number is too large. The spire would have two very bright strobes, one with red lens, one with green lens. These strobes would flash at TBD rate (multiplier should get the repetition rate--reasonably high) i.e., for each 10 births--green flashes and for each 10 deaths--red flashes. The strobes should be close to each other so they would be in the same field of view.

Author: Kenneth D. Cashion
HA41, Building 1100, ERL
National Space Technology Laboratories
(601) 688-1930

Disney Coordinator for Working Group: Jerry Aldrich

Title: Measure Up!

Relevant Show Area/
Infrastructure: Outreach/Education

Concept: In this exhibit, the public will have a chance to see the amazing world of measurement. Lord Kelvin once said that you cannot know something unless you can measure it--and obtain a quantitative value. The effect of this display will be to highlight the concept of the world around us and its measurement. The physical properties to be shown could include length, weight, force, temperature, pressure, time, etc.

As an example, consider the measurement of length. At first the visitor sees a simple concept of the human length element such as the foot. Then the concept is transferred to the ruler. The use of the transit comes next with length calculated from angles. As the technology improves, the ability to measure improves and drives our understanding of the world. For example, the use of strain gauges will be demonstrated--as will the use of lasers to determine distance accurately. The point made is always that the better we can measure it--the better we can understand it.

A second exhibit can be the measurement of time. As before, the display begins with the early days of time-keeping--the sun cycle. As man advances, the ability to measure time improves from the sundial to the water clock to the pendulum/escapement clock. As we approach the modern day, the ability to measure time improves to the resonating crystal and to the atomic clock. That is quite a picture for the public: from the solar cycle to the vibrations of atoms--from the feat of measuring one sunlight day to the ability to measure the time it takes light to travel several feet.

Other such displays might include the history of weight measures from old balances to microbalances and temperature measurement from thermometers to infrared quantitative imaging systems. The number of display ideas is only bounded by the number of physical measurements!

Author: Joseph S. Heyman
MS231
NASA Langley Research Center, Hampton, VA 23665
(804) 865-3036

Disney Coordinator for Working Group: John F. Zovich

Title: Behind the Scenes Tours

Relevant Show Area/
Infrastructure: Outreach/Education

Concept: I have been to Epcot's Universe of Energy and enjoyed it. The batteries powering the cars are partially charged by photovoltaic arrays. I would have loved much more, if I could have gone around the solar arrays to get an idea of the magnitude of array size and power availability to comprehend the system. This is beyond the entertainment value to the educational value of how the futuristic system would be used, what they might look like, etc. A lot of people would love to take such a tour if a regular opportunity is offered. They will not only enjoy the entertainment and educational values of the Magic Kingdom/ Epcot Center, but would leave with a great sense of appreciation for the engineering advances used in the attraction. In a sense they are quite futuristic in themselves.

Author: Ross McCluney
Florida Solar Energy Center
(305)783-0300

Title: EPCOT--Behind the Scenes

Relevant Show Area/
Infrastructure: Outreach/Education

Concept: The behind-the-scenes story of EPCOT is as interesting, challenging and educational as most of the shows. It might be highly attractive to the average visitor to obtain some insight into this.

There are several ways this might be done. Where practical, actual behind-the-scenes tours by pavilion or facility might be available such as in "LAND." Each pavilion could have a section set aside at the end of the route showing how some of the shows are done.

Another option might be a video screen display in a centralized location, such as Communicore. Questions of interest might include the mechanisms of audioanimitronics, the critical synchronization of the circle vision cameras, the depth of field and lifelike character of the 3-D movies system computer control, etc.

Author: Reed Barnett
PT-TPO-A
John F. Kennedy Space Center
(305) 867-3017

Title: Traveling Tech Train

Relevant Show Area/
Infrastructure: Outreach/Education

Concept: There are people who cannot afford to travel to Florida or California to see the wonders of Disneyworld. A Tech Train should be developed to travel throughout the year to small and large U.S. cities to provide entertainment and information to the attendees. In this manner, most people will have the opportunity to attend and enjoy the end products of technology and see how they fit into the big picture.

Author: Chuck Kubokawa
D.O.
Ames Research Center
(415) 694-5554

Disney Coordinator for Working Group: Ben Schwegler

Title: Yesterday's and Today's Composites

Relevant Show Area/
Infrastructure: Outreach/Education

Concept: Illustrate the principles of composite structures. Show how wood and lacquered cloth were the composites of yesterday and how the new composites of today are influencing energy conservation (i.e., lighter weight structures) and providing new ways to build the 21st century machines and structures.

Author: Howard Goldstein, Ph.D.
Ames Research Center
Moffett Field, CA 94035
(415) 694-5378

Title: History of Materials

Relevant Show Area/
Infrastructure: Outreach/Education

Concept: This display would show how advances in technology were in turn dependent on materials development. The effects of running out of raw materials and then "inventing" new technology to replace them could be illustrated.

Author: Howard Goldstein, Ph.D.
Ames Research Center
Moffett Field, CA 94035
(415) 694-5378

Title: Effect of High Temperature Materials on Development of Energy Efficient Engines

Relevant Show Area/ Infrastructure: Outreach/Education

Concept: This type of display could illustrate how thermodynamic efficiency is increased by increasing operating temperature and how jet engines, reciprocal and turbines are being improved.

Author: Howard Goldstein, Ph.D.
Ames Research Center
Moffett Field, CA 94035
(415) 694-5378

REMOTE SENSING

- Technology of Remote Sensing Kiosk
- Photographing the Earth
- Earth Images from the Shuttle

Title: Technology of Remote Sensing Kiosk

Relevant Show Area/
Infrastructure: Remote Sensing

Concept: The future world will have world-size problems the solutions of which require information from any place on the globe. On-the-ground surveys are too slow and too expensive to be used in even some small, local areas. Remote sensing is the only viable method of acquiring the needed information from large areas. Making decisions affecting such large geographical areas will be hazardous without the insight that remote sensing will provide. This display consists of a cut-away multispectral scanner demonstrating general scanner operation. With hands-on "terminal" operation (or touch screen), visitor selects a geographical area and the screen displays the Landsat-acquired scene in each raw-data band as well as the final Landcover classification. The visitor can solve many utilization problems involving: soil erosion control, fire control modeling; highway construction routes; flood assessments; dam sighting; as well as, where any of of 15 land cover classifications are located. The visitor can also call up to the screen the acreages and percentages of the total area the individual classes occupy. Presentations can be oblique (3D) projection for scenes with varying elevations. These applications have been demonstrated by ERL with Monsanto, International Harvestor, Navaho Indian Nation, Cotton Inc., Ducks Unlimited, AMAX (coal mining), Drug Enforcement Administration, ad infinitum. All data can be stored on Laser Disc.

Author: Kenneth D. Cashion
HA41, Building 1100, ERL
National Space Technology Laboratories
(601) 688-1930

Disney Coordinator for Working Group: Jerry Aldrich

Suggested Sponsor: For cut-away multispectral scanner--
Daedalus Enterprises, Inc.
P.O. Box 1869
Ann Arbor, MI 48106
(313) 769-5649

Disney's established contacts for Data Proocessing & Display Devices.

NASA, ERL for Landsat Data Processing.

Coordination and possibly cut-away scanner. (Ken Cashion, (601) 688-1930).

Title: Photographing the Earth

Relevant Show Area/
Infrastructure: Remote Sensing

Concept: One of the favorite pastimes of space travelers is looking at, or photographing, the Earth. It would be possible to simulate the view from a Space Shuttle window, i.e., the Earth passing below, and the procedures followed by astronauts in taking pictures, to allow the guest to "take" his own picture of the Earth. In actuality, astronauts are provided targets of special importance and asked to take a picture if the viewing is good (no clouds, etc.). It should be possible to allow a guest to view 3-4 minute segments of the Earth's surface giving them a photo opportunity of their home city, favorite natural feature (desert, tropics, islands, volcanos) selected from a menu, and (possibly) be given a print based on real space photography. A book of space photographs could be available in a concession stand and further technical information about space photography at the outreach center. Would it be possible to use their own camera to film the scene?

Author: M. B. Duke
SN
NASA/Lyndon B. Johnson Space Center
(713) 483-4464 FTS: 525-4464

Disney Coordinator for Working Group: Dick Fox

Title: Earth Images from the Shuttle

Relevant Show Area/
Infrastructure: Remote Sensing

Concept: Using optimal and infra-red and microwave images of the earth, put together a mosaic to allow visitors to see their home town from space. The Shuttle Imaging Radar provides much data of this type.

Author: Harry O. Erwin
EE6
Lyndon B. Johnson Space Center
(713) 483-3660

Disney Coordinator for Working Group: Dick Fox

SPACE

- Visions of NASA
- NASA Video at Epcot
- Selected OMNIMAX Space Films
- Colliding Galaxies
- Hall of Planets
- Higher Plants for Recycling Human Waste into Food, Potable Water, and Revitalized Air in a Closed Life Support System
- Space Pavilion
- Space Travel
- Space Agriculture
- General Framework for Space Pavilion
- Tour of Planets
- Your Tour in Space
- The Universe as Revealed by the Space Telescope
- Tour of Planets
- Space Station Display
- Space Station Mock-Ups
- Lunar Base
- Exploring the Planets
- Live from Space--Expansion
- Live from Space
- Moon Colony (and Mars Base)
- Planetary Grand Tour
- Automated Space Beam Builder
- Space Infrastructure Evolution (or) Increasing Our Capabilities in Space
- Plant Tropism
- Orbital Day/Night Plant Cycle Simulation
- Space Display
- Permanent Audio/Video Space Theatre

Title: Visions of NASA

Relevant Show Area/
Infrastructure: Space

Concept: There have been many exciting moments in the history of NASA--the first American in space, the lunar orbiter for photographic studies prior to manned landing, the Apollo 13 mission problems, the first man on the Moon, the first pictures from the surface of another planet, the planetary photographic flybys, etc. We have shared these items with the public but have not shared the magnetism, the electrified moment of discovery that takes place for those who worked years for the brief flash of success--or failure.

We could have a series of video tapes with proper commentary that set the scene back to the "moment of truth"--sort of a YOU ARE THERE in high technology. These will not just be news releases. They will be as close as possible to a reenactment of the launch (or mission goal) seen through the eyes, mind, and emotion of one at the scene.

For example, I saw man's first look at the surface of another planet while the Viking Lander returned data line by line. The prelanding information was as exciting as any space movie! We knew we were seeing data 18 minutes late (the travel time of radio waves to Mars) and saw discrepancies in the flight path but then the automatic onboard flight control system would bring the data in line--again--and again--until we watched the indication of a soft landing. Within minutes, we saw the first view of the Martian surface.

Similar tales can be told for each mission. The public is motivated by the concept of space and can share in the thrill with the right story line. These stand-alone viewing exhibits will have enormous audio low frequency drivers combined with large screen projection systems. The viewer will walk away from this exhibit having experienced a "slice of space."

Author: Joseph S. Heyman
MS 231
NASA Langley Research Center, Hampton, VA 23665
(804) 865-3036

Disney Coordinator for Working Group: John F. Zovich

Title: NASA Video at Epcot

Relevant Show Area/
Infrastructure: Space

Concept: NASA video of activities at the Kennedy Space Center would be relayed either through our satellite or other means from the Kennedy Space Center to Epcot. This video would show launch preparations such as rollouts of the shuttle to the pad, launch rehearsals, launches and landings, press conferences, and other activities as they occur.

During the periods when no live activities are available, a video tape could be put together to show what sort of things happen daily at the Kennedy Space Center.

NASA could prepare a short report called "This Week in Space" if a news format is selected. News of what is happening is already broadcast to other centers so could be picked up with a small dish antenna or video tape.

Author: Hugh W. Harris
PA-PIB
John F. Kennedy Space Center
(305) 867-2468

Disney Coordinator for Working Group: John Zovich

Title: Selected OMNIMAX Space Films

Relevant Show Area/
Infrastructure: Space

Concept:

1. "Tomorrow In Space," Ruben Fleet Theater, San Diego, California. Contact: Dr. Jeff Kirsh. Structural Assembly in Space, etc.

2. "The Dream Is Alive," IMAX Systems Corporation, Toronto, Canada. Contact: Rod Shannon.

Author: Georg von Tiesenhausen
PS01
Marshall Space Flight Center
(205) 453-2789; FTS 872-2789

Disney Coordinator for Working Group: Richard Fox

Title: Colliding Galaxies

Relevant Show Area/
Infrastructure: Space

Concept: Use computer-generated frames in movie showing theoretical approach, passthrough of 2 galaxies. This show would graphically demonstrate use of advanced computational sources and time-space compression.

Author: Dick Haines
LH
Ames Research Center
(415) 694-5719

Disney Coordinator for Working Group: Dick Fox

Relevant Show Area/
Infrastructure: Space

Concept: The "Hall of Planets" is a new space pavilion that is composed of four separate and self-contained exhibits. The four components of this pavilion are briefly summarized below.

1. Earth: Our Planetary Habitat

   This exhibit deals with the origin, evolution, and future of our planet, the land, atmosphere, ocean, and life. Specific topics to be addressed in this exhibit include:

   A. The origin of the Earth and the other planets

   B. The early history of the Earth

   C. The origin and evolution of the continents (land), atmosphere, ocean, and biosphere (the totality of all living systems). The origin of the atmosphere, ocean, and biosphere were closely related. The gases that formed the atmosphere were originally trapped in the Earth's interior and were released via volcanic activity. Water vapor, the major constituent of the trapped gas that formed the atmosphere condensed out of the atmosphere forming the oceans. Atmospheric lightning and solar ultraviolet radiation acting on the simple volcanic gases in the early atmosphere formed organic molecules of increasing complexity, which eventually formed the first living systems. Once life evolved and diversified, photosynthetic organisms developed and produced oxygen as a byproduct of the photosynthesis process. Oxygen accumulated to become the second most abundant gas in the atmosphere. Other organisms, mostly microorganisms, produced a variety of different atmospheric gases as a result of various metabolic processes, including methane, ammonia, nitrous oxide, hydrogen sulfide, etc. Hence, the evolution of the atmosphere ocean, and life were closely coupled over geological time and still are today.

   D. The transfer of gases and energy between the land, atmosphere, ocean, and biosphere. The land, atmosphere, ocean, and biosphere are intimately coupled, a relatively recent realization that has led to the concept of "global habitabil-

ity." Under the global habitability concept, the land, atmosphere, ocean, and biosphere are studied as a coupled, interacting system, rather than being separate, isolated entities.

E. The future of the Earth, its land, atmosphere and ocean. This component will address the impact of our high technology, industrialized society on our planetary habitat and environment. Some topics to be covered will include the effects of energy production (i.e., fossil fuel burning) and transportation systems (i.e., high temperature internal combustion) on the atmosphere, ocean, and land. Some high technology, industrialized activities may impact the land, atmosphere, ocean, and biosphere, e.g., the global deterioration of air quality, and the global increase of air pollution and acid precipitation (all of which negatively impact agricultural production, forests, lakes, etc.), the possible inadvertent depletion of ozone in the upper atmosphere (which shields the land and the biosphere from biologically lethal solar ultraviolet radiation) and possible changes in climate resulting from the introduction of man-made gases produced by fossil fuel burning, internal combustion, and various agricultural activities, such as increased use of nitrogen fertilizers and slash/burn practices. This exhibit will consider the impact of these environmental problems on the land, atmosphere, ocean, and biosphere.

Several of the topics to be addressed in this exhibit are closely related to other Epcot pavilions, for example, topics D and E are related to the land and topic E is related to the World of Motion and the Universe of Energy.

2. Sensing Our Planetary Habitat: The Land, Atmosphere, Ocean, and Biosphere

Earth-orbiting spacecraft, both unmanned and manned (e.g., the space shuttle and future space station) permit observations, measurements, and monitoring of the planet Earth (the land, the atmosphere, the oceans and the biosphere) on a truly global basis. This exhibit will demonstrate the science and technology of remote sensing of our planet and the application of these measurements. The applications of remote sensing include crop inventory and assessment; forest inventory and assessment; surface and

subsurface mineral inventory, including the search for fossil fuel and minerals from space; monitoring of the atmosphere, weather, and climate; the variation of the sea surface with time; the distribution of surface ice and snow; regions of ocean productivity; and assessing the various environmental problems and concerns listed under 1E.

3. Journey to the Planets

This exhibit will take visitors on a journey to the other planets (represented by models simulating the planet and its satellite system). A car similar to the transportation device in Spaceship Earth will simulate the trajectory of a planetary probe to the other planets. As the planetary probe, i.e., the car, approaches the particular planet, a color slide presentation will show closeup photographs of the planet and a taped narrative will summarize our current understanding of the planet.

The exploration of the planets by Mariner (Mercury, Venus, and Mars), Viking (Mars), Pioneer (Venus, Jupiter, Saturn), and Voyager (Jupiter, Saturn, Uranus [1986] and Neptune [1989]) has been one of the most significant and exciting advances in the history of science and technology. This exhibit also sets the stage for the fourth and final exhibit in the "Hall of Planets" pavilion called Planetary Engineering.

4. Planetary Engineering

Eventually the planets, as well as the Moon, will be inhabited by humans. Colonization of these other worlds will be the true "experimental prototype community of tomorrow." Planetary engineering includes the man-made transformation of a planet to make it more suitable for human habitation. An example of planetary engineering is the large-scale transformation of the predominantly carbon dioxide atmosphere on Mars to a more hospitable Earth-like atmosphere, composed of oxygen, via the introduction of photosynthetic organisms. Planetary engineering is being discussed and studied at many institutions, including within NASA. Planetary engineering combines elements of the other three exhibits in the pavilion.

All of the topics included under Earth: Our Planetary Habitat, including the Earth, past, present, and future and the various environmental problems, and all of the topics included under Journey to the Planets, including detailed discussions on each planet, are covered in a new book, The Photochemistry of Atmospheres: Earth, The Other Planets and Comets written and edited by Joel S. Levine, Academic Press, Orlando, Florida (1985). The principles of planetary engineering are discussed in On the Habitability of Mars: An Approach to Planetary Ecosynthesis, written and edited by M. M. Averner and R. D. MacElroy, NASA Special Publication-414 (1976). (This publication is available from the National Technical Information Service, Springfield, Virginia 22161.)

Author: Joel S. Levine
Atmospheric Sciences Division, MS 401B
NASA Langley Research Center
(804) 865-2187

Disney Coordinator for Working Group: Ben Schwegler

Title: Higher Plants for Recycling Human Waste Into Food, Potable Water, and Revitalized Air in a Closed Life Support System

Relevant Show Area/ Infrastructure: Space

Concept: In pursuance of U.S. goals in space exploration, astronauts and scientists may need to stay for extended periods ot time in celestial stations and planetary bases. As the number of people, length of time, and remoteness in space increases, the total reliance on expendables for air, water, and food becomes more and more impractical. Therefore, a closed, or partially closed, ecological life support system that is reliable, stable, and reproducible needs to be developed to regenerate the waste into food, oxygen, and potable water.

One of the potential health problems associated with closed facilities was identified during the Skylab missions. The presence of more than 300 chemicals was detected in the Skylab atmosphere during the occupancy of the Skylab III crew. Of this number, 107 were identified by mass spectral methods. These indoor air pollutants contained toxic chemicals such as benzene, toluene, dichlorobenzene, naphthalene, benzaldehyde, benzonitrile, and numerous other hazardous chemicals. Although activated carbon filters were used to clean the Skylab atmosphere, a bio-regenerative air purification system is desirable for long duration in space.

The Skylab atmospheric analysis also demonstrated the potential health hazards that can develop in earthly homes, offices, hospitals, etc. as they become more energy-efficient by being sealed to a point where ventilation rates are drastically reduced.

Research at NASA's National Space Technology Laboratories (NSTL) during the past 10 years has demonstrated the potential for using both aquatic and food plants for recycling human waste in a closed system. Recent studies have also demonstrated the ability of plants to remove pollutants such as formaldehyde, carbon monoxide, and nitrous oxide from closed systems.

A pavilion or infrastructure at EPCOT showing plants being used to recycle human waste and removing hazardous chemicals from the inside atmosphere and revitalizing the air would not only be an excellent display for public viewing but would allow NASA and NASA contractors to collect vital information needed for perfecting a closed ecological life support system for future space stations and lunar bases.

The application of plants for removing hazardous air pollutants from inside energy-efficient buildings is also an innovative concept that would make an excellent viewing display and could possibly receive funding support from various government and private organizations. The National Institute of Building Sciences, 1015 15th Street, NW, Suite 700, Washington, DC 20005, is especially interested in this concept for future structures.

Author: B. C. Wolverton, Ph.D.
GA30
NASA/National Space Technology Laboratories,
George C. Marshall Space Flight Center
(601) 688-3155

Title: Space Pavilion

Relevant Show Area/
Infrastructure: Space

Concept: A Space pavilion containing the following elements is suggested:

1. The most important NASA Technology Utilization spin-offs to all fields for both ongoing and completed projects. An example is "Multispectral Analysis of Magnetic Resonance Imaging."

2. Showcase leading edge space station and related shuttle technologies in all major technical disciplines.

3. Conduct actual research and development on site in the public view (space station and shuttle experiment ground test beds for example). Involve the public in prototype testing of new devices and processes. Examples are: simulators, nondestructive evaluation, computer vision and graphics, image processing, fiber optic leak detection, remote sensing of hydrazine (laser), electron microscope materials identification, and liquid oxygen loading expert systems.

4. Host international symposiums on specific space topics at the pavilion. Conduct ongoing public education/ awareness (NASA Technology Utilization booth for example).

Author: Robert L. Butterfield
PT-TPO-A
John F. Kennedy Space Center
(305) 867-3017

Disney Coordinator for Working Group: Jerry Aldrich/Lou Kompare

Title: Space Travel

Relevant Show Area/
Infrastructure: Space

Concept: Who knew air travel would be so common after the first test flight by the Wright brothers a few decades ago? Who knows, space travel could be so common within a few decades. The odds are for it. But what would it be like? Can people get a glimpse of it in some kind of ride?

A ride to space is suggested that will take people into an orbit around Earth in a "space shuttle." Visual aids can help in the beginning for takeoff, SRB separation, and entry into the orbit (somewhat similar effects as in Eastern's "If you had wings" at Magic Kingdom). Once in the orbit, you see Earth below and stars around. You see different satellites in several orbits (polar, geosynchronous). There is a space station of the future. There is also a solar array field collecting sunlight and sending it to Earth via microwaves. Model astronauts are walking in and out of their space shuttles and repairing/working on satellites. While returning from the trip, you face the red-hot glow of re-entry heat, communications blackout, the approaching Earth and landing strip, chase planes and final landing. All these affects would be visual.

Advantages of this kind of ride would be that, besides its futuristic appeal, it can handle a lot of people in a short time, which is a requirement if there are to be large numbers of visitors.

Author: Ross McCluney (through Reid Barnett, KSC)
Florida Solar Energy Center
(305)783-0300

Title: Space Agriculture

Relevant Show Area/
Infrastructure: Space

Concept: This writing is included for completeness. The activities described below are currently being pursued with the personnel at EPCOT and in the Land Pavillion.

1. Display innovative systems that have promise as units to support and deliver nutrient solutions to higher plants in space.

2. Research in close cropping techniques especially as they relate to control of pests and pathogens.

3. Exchange researchers and participate in research symposia as appropriate.

Author: William Knott
MD-ENV
John F. Kennedy Space Center
(305) 867-3152

Title: General Framework for Space Pavilion

Relevant Show Area/
Infrastructure: Space

Concept: General Framework for Space Pavilion:

- Connections with other Disney Pavilions and other discipline areas
- Should define environment (what is different, what is similar?)
- Why go into space?

Living:

- View of earth from Orbit-200M
- Habitable modules (temporary/permanent)
- Weightless games
- Familiar environments to retreat to

Working:

- EMU/EVA simulator (hand controllers keyed to video/holographic projection of station)
- Earth-related jobs (cooks, plumbers, etc.)
- Science in space (colliding galaxies simulation)
- Construction/repair assembly (beam builder, omnimax film of solar max mission)
- Moving masses in 0-6 (6 D.F. simulator, etc.)
- Information Management (on-board data bases, etc.)
- Malfunction procedures on data base

Operations:

- Orbital mechanics simulator (rendezvous)
- "NASA select" video
- Motion base simulations of launch, docking, reentry, landing
- "Grand Tour" of planets

Author: Chuck Lewis
EL15
NASA, George C. Marshall Space Flight Center
(205) 453-0080

Title: Tour of Planets

Relevant Show Area/
Infrastructure: Space

Concept: Reconstruct the Mars ride to simulate the audience taking a tour of the Solar System making use of information from the NASA Spacecraft. This would be supplemented with information from ground-based observatories working in the visible light area as well as using radar and other areas of the spectrum.

Spacecraft have flown by or landed on Mars, Mercury, Venus, Jupiter, and Saturn. Spacecraft will pass by Uranus in 1986 and Neptune a year or two after that. The exhibit could be designed to make use of the data as they become available.

The show would continue with a look out towards the edge of the universe now that spacecraft have left the solar system.

The project would use other images from Space Telescope after it is launched.

Author: Hugh W. Harris
PA-PIB
John F. Kennedy Space Center
(305) 867-2468

Title: Your Tour in Space

Relevant Show Area/
Infrastructure: Space

Concept: The Space Pavilion would concentrate on what we expect to be doing in space during the next 20 to 30 years. It should be acknowledged that this is dependent on the actions of the White House and Congress . . . and changes from time to time.

The pavilion would show the concepts of our early Space Station, later Space Stations, Lunar Bases, and our first trip to Mars.

It would show a little of what has been happening in the Space Program that has made these dreams possible and the benefits that have accrued so far, as well as what might be expected in the future.

The entire pavilion should be a very upbeat experience that makes people feel they are part of something important and that the program is adding new dimensions to the human experience.

Author: Hugh W. Harris
PA-PIB
John F. Kennedy Space Center
(305) 867-2468

Disney Coordinator for Working Group: John Zovich

Title: The Universe as Revealed by the Space Telescope

Relevant Show Area/
Infrastructure: Space

Concept: This subject could be integrated into a wide range of displays such as Space Pavilion, Communicore, Space ship earth, etc.

The specific display configuration could take many forms but should be positioned to afford the viewers complete attention and engage their minds for a period of time.

The focus would be NASA's space telescope to be placed in earth orbit in 1986, including some specific data on design and configuration. Discuss its capabilities to extend man's vision of the universe (to 14 billion light years). Display typical telescope scenes of astronomic bodies. Give the viewer a feel for the immensity of the universe in space and time. Stars are a long way off and a long time ago. Introduce the time/distance connection. We see stars as they were and where they were 14 billion years ago. What are they and where are they today? This is the kind of understanding and challenge EPCOT should be encouraging. This display could be near real time once operations begin and could be kept constantly up to date with current data.

Author: Reed Barnett
PT-TPO-A
John F. Kennedy Space Center
(305) 867-3017

Title: Tour of Planets

Relevant Show Area/
Infrastructure: Space

Concept: Take visitors on a tour of the sun's solar system. Start by entering a "space station" which would be waiting area and point from which "space vehicles" are entered for "voyage." While waiting in "Space Station" for ride through "Solar System" visitors could view earth through windows in "space station" as earth "turns below." Important landmarks and points of interest could be noted as the earth is viewed. When riding to planets, they could be seen in a manner similar to a grand tour. The ride would take the visitor on close passes to planets showing views as seen from Voyger, Viking and other space craft. The voyage should include the moons of the planets and a ride through Saturn's rings and asteriod belt. Make as many closeups as possible. Planets could be separated by walls to prevent scenic planets next to each other.

Author: Tom Hammond
PT-TPO-A
John F. Kennedy Space Center
(305) 867-3017

Title: Space Station Display

Relevant Show Area/
Infrastructure: Space

Concept: The advanced technology and scientific benefit from a space station could be demonstrated through a space station display. A model of the NASA space station Reference Configuration could be constructed (or perhaps acquired from NASA) and installed. Video tapes have been made showing computer simulation of space station deployment and assembly in orbit which would make interesting displays. Other display board or video vignettes could be developed as ancillary displays which could show various aspects of space station assembly, operation, living, scientific research, etc.

Author: Reed Barnett
PT-TPO-A
John F. Kennedy Space Center
(305) 867-3017

Title: Space Station Mock-Ups

Relevant Show Area/
Infrastructure: Space

Concept: Construct a mock-up of one of the Communities of Tomorrow--the Space Station. This can be a show-place of required technologies and lifestyles of the new frontier of space. New materials, new drugs, new communications equipment, and new power generation equipment can be shown while giving the visitor a touch of out-of-this-world living.

Author: Harry O. Erwin
EE6
Lyndon B. Johnson Space Center
(713) 483-3660

Title: Lunar Base

Relevant Show Area/
Infrastructure: Space

Concept: Rationale: A number of themes can be represented in a lunar base that are of great interest to people:

1. Space exploration--new vistas, separation from earth.
2. Challenge of a developing frontier--utilizing intelligence and natural materials to carve out a home away from Earth.
3. New techniques, new products, new wealth, new opportunities for people gained from activities on the Moon.

This could be an opportunity that would begin to be implemented in the next 15-20 years by NASA, by some other country or countries, or even by private investment.

Some of the elements of a Moon Base that could be included would be:

1. A habitat, initially a space station-like cylinder, but growing toward new architectures utilizing expandable structures brought from Earth and natural lunar materials to increase and make more livable the habitable volume.
2. A mine, utilizing considerable automation, to derive raw materials that are used to produce oxygen for rocket propellant; glass in a variety of forms for insulation, structures, etc., and metals for wires, tanks, structures, etc. The plants for producing these materials can be included.
3. A lunar experimental farm, a 21st Century extension of "The Land," which grows food for the colonists, recycles waste products for reuse, gradually increasing the Earth-like characteristics of the lunar base, and carries out experiments toward improving plant and animal strains to feed a growing population.
4. A space port, for flights to and from Earth.
5. A surface (or tunnel) transportation system, utilizing magnetic levitation to move people between the base.
6. A scientific research station on the lunar farside, out of sight of Earth (just around the limb), where a radiotelescope surveys the sky.

Many other ideas in power, communications, science, technology, etc., can be shown.

One aspect of such a presentation could be that advanced technologies that will prove useful to the Earth could be developed in a nonadversarial framework, i.e., nuclear power, magnetic levitation transport, genetic engineering of animals. Also, some concepts can be presented that are simple, but not necessarily widely understood, e.g., the lunar farside cannnot view Earth (as one travels from base to scientific station, the Earth disappears from view, although the Sun rises and sets.

It could be very exciting, thought provoking, fun, and evolve as ideas and concepts become closer to reality.

Author: M. B. Duke
SN
NASA/Lyndon B. Johnson Space Center
(713) 483-4464 FTS: 525-4464

Title: Exploring the Planets

Relevant Show Area/
Infrastructure: Space

Concept: Many ways might be used to place people into greater touch with the planetary exploration done by and to be done by NASA. A lot of this is in the past, but much is still to come, and the idea of "seeing through different eyes" may be utilized. For example, a space voyager might fly to Venus, following the "Evening Star," brighter and brighter, until an orbit is achieved. The planet appears featureless in visible light, but U-V glasses might be put on to see cloud structure as displayed by Mariner 10, or "RADAR" glasses could be donned to see through to the surface, as shown by Soviet and eventually by U.S. experiments. Each of the planets has their own attractions--Mars, Jupiter, Saturn, Neptune, Uranus, and their satellites. Enough to put into a 20-minute journey with no effort.

Author: M. B. Duke
SN
NASA/Lyndon B. Johnson Space Center
(713) 483-4464 FTS: 525-4464

Title: Live from Space--Expansion

Relevant Show Area/
Infrastructure: Space

Concept: Disney would provide a manned module for space station for education and entertainment purposes. Could also provide crew including kids, space entertainers. There would be 12-16 hour cable TV coverage for Disney channel or syndication or educational TV. Associate sponsors to defray cost would start slow (maybe) but would grow very fast.

Cost of space station modules will decrease after development. Aim project for late 90's time frame.

A further extension of this could be a space university, perhaps coupled with an earth bound Disney University.

This would be a very long-term project but Disney has this expertise for long-term planning.

Author: Lee Tilton
S
NASA Headquarters
(202) 453-1161

Title: Live from Space

Relevant Show Area/
Infrastructure: Space

Concept: There are an increasing number of manned space missions. In the interest of firing up our youngsters (Today's Disney visitors 10-30 yr old will man our space station in the 90's) conduct a live daily interaction in a space pavilion with the Shuttle. Could be 15 min to one hour in duration. Conduct live demonstrations of aspects of manned space activities (living, working, etc.). Broadcast live for interaction and/or tape segments. Suitable for Disneyworld, Disneyland, cable TV, museums, etc. Could even syndicate. This could expand into a school program or a subscription program (commercial potential).

Author: Lee Tilton
S
NASA Headquarters
(202) 453-1161

Disney Coordinator for Working Group: Dick Fox

Title: Moon Colony (and Mars Base)

Relevant Show Area/
Infrastructure: Space

Concept: A closed dark building with black light and starry sky with Earth contains the base. Surface material and facilities are brightly illuminated. Lunar surface mining and drilling in progress. Oxygen factory in simulated automated operation. An echoic room, no sounds except occasional narration. Access to interior of buildings. Lunar materials processing (building blocks, aluminum structures, solar cells, etc.). Show MSFC automated beam builder in operation. Have visitors lift beams. Give each visitor a piece of beam.

Additional information on this concept is available from:

Doris J. Rouse
Technology Applications Team
Research Triangle Institute
P.O. Box 12194
Research Triangle Park, NC 27709

Author: Georg von Tiesenhausen
PS01
George C. Marshall Space Flight Center
(205) 453-2789; FTS 872-2789

Disney Coordinator for Working Group: Richard Fox

Title: Planetary Grand Tour

Relevant Show Area/
Infrastructure: Space

Concept: In a dark enclosed structure (possibly inflated structure) using black light, a roller coaster type structure and a slow moving train (passengers looking forward) makes a roundtrip to all planets. Approach (deceleration) and departure (acceleration) are simulated by moving the vehicle up- or downhill. The planetary displays surround the viewers including a starry sky. Use of OMNIMAX projection. Background rocket sounds and narration. Vehicle moves smooth and noiseless. Return to Earth through a psychedelically illuminated tunnel.

Additional information on this concept is available from:

Doris Rouse
Technology Applications Team
Research Triangle Institute
P.O. Box 12194
Research Triangle Park, NC 27709

Author: Georg von Tiesenhausen
PS01
George C. Marshall Space Flight Center
(205) 453-2789; FTS 872-2789

Disney Coordinator for Working Group: Richard Fox

Title: Automated Space Beam Builder

Relevant Show Area/
Infrastructure: Space

Concept: The MSFC developed automated space beam builder (or a replica) shall be shown in operation. Aluminum ribbons are fed into one end of the machine and a finished triangular beam comes out the other end. Ten foot lengths can be cut off and the public could lift these and experience the light-weight nature of the structure. (See also Moon Colony proposal.)

Additional information on this concept is available from:

Doris J. Rouse
Technology Applications Team
Research Triangle Institute
P.O. Box 12194
Research Triangle Park, NC 27709

Author: Georg von Tiesenhausen
PS01
George C. Marshall Space Flight Center
(205) 453-2789; FTS 872-2789

Disney Coordinator for Working Group: Richard Fox

Title: Space Infrastructure Evolution (or)
Increasing Our Capabilities in Space

Relevant Show Area/
Infrastructure: Space

Concept: Movie or model that portrays growth of space infrastructure of assets from 1960 to projected options for 2020: Mars mission, Lunar base, asteriod mining, etc. The scenario shows the buildup of space stations, satellites and transportation elements and describes how each element contributes to different capabilities: exploration, observation, innovation, servicing and maintenance, storage, assembly and transportation mode support (e.g., refueling, checkout). It defines what space is and why it is important for us as a nation to be there. Sophistication of display could be increased with time from graphics ($250K) to interactive models ($10M).

This display could or would set the framework for the other space pavilion displays.

Author: Lee Tilton
S
NASA Headquarters
(202) 453-1161

Disney Coordinator for Working Group: Dick Fox

Title: Plant Tropism

Relevant Show Area/
Infrastructure: Space

Concept: Plants react in specific ways to external forces. A relatively simple way to show how plants react to a combination of gravity and centrifugal forces is shown in the enclosed drawing. The plants will grow along the resultant force vector between gravitational and centrifugal forces.

Additional information on this concept is available from:

Doris J. Rouse
Technology Applications Team
Research Triangle Institute
P.O. Box 12194
Research Triangle Park, NC 27709

Author: Georg von Tiesenhausen
PS01
George C. Marshall Space Flight Center
(205) 543-2789; FTS 872-2789

Disney Coordinator for Working Group: Richard Fox

Title: Orbital Day/Night Plant Cycle Simulation

Relevant Show Area/
Infrastructure: Space

Concept: An unusual area of plant behavior is yet unexplored and can easily be simulated on the ground. Future plants in Earth orbit go through a day/night cycle in about 90 minutes (about 35 minutes dark and 55 minutes in the sun). It would be of great interest to study and present the results of this cycle and its effects on different plants.

Additional information on this concept is available from:

Doris J. Rouse
Technology Applications Team
Research Triangle Institute
P.O. Box 12194
Research Triangle Park, NC 27709

Author: Georg von Tiesenhausen
PS01
George C. Marshall Space Flight Center
(205) 453-2789; FTS 872-2789

Disney Coordinator for Working Group: Richard Fox

Title: Space Display

Relevant Show Area/
Infrastructure: Space

Concept: In a few weeks NASA will select a basic space station configuration. There could be a full-size mock-up assembled on concrete pedestals with the lesser structure guyed against wind damage. The entire structure should be high enough that visitors will walk under but not in (or on) it. Underneath there would be room for any other types of landscaping, i.e., gardens, restrooms, information kiosks, benches, sidewalks, fountains, etc.

It would not be excessively heavy, but should impress anyone walking under it. It would be one of the more photographed features. A "character" in a cooling space suit (with visor down so he would have no "identity") could be in the area to pose with visitors. He could be pulling a "lunar surface" work cart full of "pamphlets" with information about the space station.

Author: Kenneth D. Cashion
HA41, Building 1100, ERL
National Space Technology Laboratories
(601) 688-1930

Disney Coordinator for Working Group: Jerry Aldrich

Title: Permanent Audio/Video Space Theatre

Relevant Show Area/
Infrastructure: Space

Concept: Continuously show films from NASA and other National Space Programs. Hook into the NASA Satellite Video System. When any appropriate shuttle or planetary mission occurs, display it in real time in the space theatre. Shuttle missions will be occurring on a monthly or more frequent schedule. Many hours of video are continuously broadcast during each flight that could be used. Much of the planetary imaging data would also be appropriate for such a continuous theatre display.

Author: Howard Goldstein, Ph.D.
Ames Research Center
Moffett Field, CA 94035
(415) 694-5378

TRANSPORTATION

- Ride Quality Meter
- Aerospace
- World of Motion Enhancement
- Advances in Aeronautics
- Collision Avoidance Radar
- Heads-Up Displays
- Landing Systems of the Future
- Global Positioning System Used to Determine Position of Car and Display it on Local Map

Title: Ride Quality Meter

Relevant Show Area/
Infrastructure: Transportation

Concept: The ride quality meter provides the first known capability for registering the effects of noise and vibration in a single ride quality index. It utilizes a comprehensive comfort algorithm developed at NASA Langley Research Center to transform individually measured vibration and noise elements into subjective units, and then combines the subjective units into a set of comfort indices that accurately and reliably reflect passenger acceptance of the environment under measurement. An internal microprocessor supervises the data acquisition process, converts data to engineering units, processes data in accordance with the NASA algorithm, and outputs a variety of ride comfort indices to an internal printer and LCD display. In essence, the ride quality meter acts as a passenger jury.

This meter should be beneficial in determining the quality of ride on all the people movers at Epcot, the Magic Kingdom, and Disneyworld. It could identify the axis contributing to any ride discomfort, which could then lead to the isolation and correction of the problem. The meter could also be useful in the improved design of new people movers.

Additional information on this concept is available from:

Doris J. Rouse
Technology Applications Team
Research Triangle Institute
P.O. Box 12194
Research Triangle Park, NC 27709

Author: Dr. Jack D. Leatherwood
MS 463
NASA Langley Research Center
(804) 865-3561

Disney Coordinator for Working Group: John Zovich and Jon Sinkinson

Title: Aerospace

Relevant Show Area/
Infrastructure: Transportation

Concept: The EPCOT suggests that we will be traveling under water and through space but apparently not through the air (except to pick oranges).

There should be a pavilion to display and demonstrate state-of-the-art advances and projections of prop and wing technology; more fuel-efficient aircraft; faster and safer aircraft; new control systems; mockups of aircraft cabins; aircraft landing simulations; air traffic control and early warning detection; etc.

There should be a presentation of more "do-able" intermediate space technologies, i.e., advance shuttles; robotic taxis moving only between orbits; laser technology in all aspects of work, and not just in entertainment, etc.

Author: Kenneth D. Cashion
HA41, Building 1100, ERL
National Space Technology Laboratoties
(601) 688-1930

Disney Coordinator for Working Group: Jerry Aldrich

Title: World of Motion Enhancement

Relevant Show Area/
Infrastructure: Transportation

Concept: The following modifications would enhance the World of Motion:

1. Robotics: Display more advanced robotic systems than the arm presented in "The Bird and the Robot." Computer (machine) vision is an important example.

2. Computer graphics: Upgrade the automobile design and display areas to leading computer graphics technology. Solids modeling is an important example.

3. Heads-Up display: Improve the prototype automobile dashboard by transferring NASA Shuttle Heads-Up display technology (contact: Harry Erwin - JSC).

Author: Robert L. Butterfield
PT-TPO-A
John F. Kennedy Space Center
(305) 867-3017

Disney Coordinator for Working Group: Jerry Aldrich/Lou Kompare

Suggested Sponsor: GM-EPCOT, NASA

Contact's Name: Harry A. Turton

Telephone Number: (305) 827-7020

Title: Advances in Aeronautics

Relevant Show Area/
Infrastructure: Transportation

Concept: Key elements:

1. Progress over time in aeronautics, wing designs, engines, windows, cockpit instruments, expanding information and workload into the future
2. Full-scale mock-ups (outside-in and inside-out perspectives)
3. Mid-air collision avoidance systems and GPS NAVSAT data input
4. Traffic navigation and intra-cockpit display of all necessary information
5. Aircraft interior layout design process (by Boeing, Lockheed, Douglas)
6. Cockpit of the Future--ultrawide visual field display
7. Clean air turbulence
8. Fog dispersal research and development.

Author: Dick Haines
LH
Ames Research Center
(415) 694-5719

Disney Coordinator for Working Group: Dick Fox

Title: Collision Avoidance Radar

Relevant Show Area/
Infrastructure: Transportation

Concept: NASA is building a radar for the Department of Transportation to sense potential collisions and to warn the drivers. This capability could be demonstrated in a "drive through hazards" ride using new technology to help prevent crashes.

Author: Harry O. Erwin
EE6
Lyndon B. Johnson Space Center
(713) 483-3660

Disney Coordinator for Working Group: Dick Fox

Title: Heads-Up Displays

Relevant Show Area/
Infrastructure: Transportation

Concept: Use the automobile of the future to show presentation of information to the driver in a safer and more convenient form. Speed, mileage, and status data can be displayed in such a way as to allow the driver to see it without removing his eyes from the road.

Author: Harry O. Erwin
EE6
Lyndon B. Johnson Space Center
(713) 483-3660

Disney Coordinator for Working Group: Dick Fox

Title: Landing Systems of the Future

Relevant Show Area/
Infrastructure: Transportation

Concept: Allow visitors to ride on the plane of tomorrow and to see a demonstration of advanced landing systems. These systems should permit landing safely in all kinds of weather and traffic conditions.

Author: Harry O. Erwin
EE6
Lyndon B. Johnson Space Center
(713) 483-3660

Disney Coordinator for Working Group: Dick Fox

Title: Global Positioning System Used to Determine Position of Car and Display it on Local Map

Relevant Show Area/
Infrastructure: Transportation

Concept: Use of the GPS to determine location on the face of the Earth is going to be widespread in the future. This system allows a receive-only determination of precise location. Manufacturers of GPS receivers forecast that the size and cost will ultimately be so small that these devices will be used by hikers, boaters, small aircraft, and anyone else who wishes to not get lost. My idea for this exhibit is to put a working version of GPS in one of the automobiles of the future and allow it to show on a Florida map, an Orlando map, and finally on an Epcot map the exact location of the automobile.

Author: Harry O. Erwin
EE6
Lyndon B. Johnson Space Center
(713) 483-3660

Disney Coordinator for Working Group: Dick Fox

APPENDIX A

WORKSHOP AGENDA

APPENDIX A

WORKSHOP AGENDA

NASA/Disney Technology Opportunity Workshop
January 15-17, 1985
Walt Disney World

Tuesday, January 15, 1985

Taskforce members arrive in Orlando for check-in at the Golf Resort Hotel (Walt Disney World) by 6:00 p.m.

6:00 p.m.	Get acquainted reception (Tournament Room--Golf Resort Hotel)
7:00 p.m.	Dinner and Disney technology presentation (Tournament Room)

Wednesday, January 16, 1985

7:30 a.m.	Buffet breakfast (Tournament Room)
8:30 a.m.	Bus departs for Epcot Center (meet in hotel lobby)
8:45 a.m.	Arrival for Epcot infrastructure tour and group photo: • Epcot computer central • Central energy plant • Growing area (Land Pavilion) • Biogasification ETU and hyacinth project
12:15 p.m.	Return to Golf Resort Hotel
12:30 p.m.	Buffet luncheon (Tournament Room)
1:15 p.m.	Small group discussions (Tournament Room)
5:30 p.m.	Meeting adjourns
7:00 p.m.	Bus departs for dinner (meet in hotel lobby)
7:30 p.m.	Dinner at Empress Lilly

Thursday, January 17, 1985

8:00 a.m.	Buffet breakfast (Tournament Room)
8:45 a.m.	Small group discussions continue (Tournament Room)
11:00 a.m.	Plenary session (each group will present concepts for technology displays)
12:00 noon	Working lunch (Tournament Room)
Afternoon	Departures

Note: Breakfast and luncheon buffets will be served from the Trophy Room Restaurant but seating will be in the adjoining Tournament Room.

APPENDIX B

NASA WORKSHOP PARTICIPANTS

APPENDIX B

NASA WORKSHOP PARTICIPANTS

John Barker, Ph.D.
Goddard Space Flight Center
National Aeronautics and Space Administration
2880 Broadway
Greenbelt, Maryland 20771
(301) 344-8978 or -7282 (message)

U. Reed Barnett
John F. Kennedy Space Center
National Aeronautics and Space Administration
MC PT-TPO-A
Kennedy Space Center, Florida 32899
(305) 867-3017

Wallace Boggs
John F. Kennedy Space Center
National Aeronautics and Space Administration
MC DD-FED
Kennedy Space Center, Florida 32899
(305) 867-2133

Wayne Bryant
Langley Research Center
National Aeronautics and Space Administration
Langley Station
MS 494
Hampton, Virginia 23665
(804) 865-2000

Robert Butterfield
John F. Kennedy Space Center
National Aeronautics and Space Administration
MD PT-TPO-A
Kennedy Space Center, Florida 32899
(305) 867-3017

Kenneth Cashion
National Space Technology Laboratories
National Aeronautics and Space Administration
Bay St. Louis, Mississippi 39529
(601) 688-1930

Michael Duke, Ph.D.
Lyndon B. Johnson Space Center
National Aeronautics and Space Administration
MC SN
Houston, Texas 77058
(713) 483-4464; FTS: 525-4464

Harry Erwin
Lyndon B. Johnson Space Center
National Aeronautics and Space Administration
MC EE6
Houston, Texas 77058
(713) 483-3660

Kenneth Fernandez
George C. Marshall Space Flight Center
National Aeronautics and Space Administration
MC EB44
Marshall Space Flight Center, Alabama 35812

J. Stuart Fordyce, Ph.D.
Lewis Research Center
National Aeronautics and Space Administration
21000 Brookpark Road
MS 302
Cleveland, Ohio 44135
(216) 433-4000, ext. 729

Ray Gilbert
National Aeronautics and Space Administration
Code 1
Washington, D.C. 20546
(202) 453-1912

Howard Goldstein, Ph.D.
Ames Research Center
National Aeronautics and Space Administration
MS 234-1
Moffett Field, California 94035
(415) 694-5378

Richard Haines
Ames Research Center
National Aeronautics and Space Administration
MS 239-1
Moffett Field, California 94035
(415) 694-5719

Hugh Harris
John F. Kennedy Space Center
National Aeronautics and Space Administration
MC PA-PIB
Kennedy Space Center, Florida 32899
(305) 867-2468

Raymond Hartenstein
Goddard Space Flight Center
National Aeronautics and Space Administration
MC 728-0
Greenbelt, Maryland 20771
(301) 344-5659

Herbert Hendrick
Langley Research Center
National Aeronautics and Space Administration
Langley Station
MS 473
Hampton, Virginia 23665
(804) 865-3777

Joseph Heyman, Ph.D.
Langley Research Center
National Aeronautics and Space Administration
Langley Station
MS 231
Hampton, Virginia 23665
(804) 865-3036

Albert Jorolan
John F. Kennedy Space Center
National Aeronautics and Space Administration
MC DL-RT
Kennedy Space Center, Florida 32899
(305) 867-4856

William Knott
John F. Kennedy Space Center
National Aeronautics and Space Administration
MC MD-ENV-C
Kennedy Space Center, Florida 32899
(305) 867-3152

Charles Kubokawa
Ames Research Center
National Aeronautics and Space Administration
MS 240-2
Moffett Field, California 94035
(415) 694-5554

Joel Levine, Ph.D.
Langley Research Center
National Aeronautics and Space Administration
Langley Station
MS 401B
Hampton, Virginia 23665
(804) 865-2187

Charles Lewis
George C. Marshall Space
Flight Center
National Aeronautics and Space
Administration
MC ET52
Marshall Space Flight Center,
Alabama 35812
(205) 453-0080

Frank Nola
George C. Marshall Space
Flight Center
National Aeronautics and Space
Administration
MC EB24
Marshall Space Flight Center,
Alabama 35912
(205) 453-4255

Doris Rouse, Ph.D.
Research Triangle Institute
P.O. Box 12194
Research Triangle Park,
North Carolina 27709
(919) 541-6980

John Samos
Langley Research Center
National Aeronautics and Space
Administration
Langley Station
MS139A
Hampton, Virginia 23665
(804) 865-3281

Lee Tilton
National Aeronautics and Space
Administration
MC SU
Washington, D.C. 20546
(202) 453-1161

George Von Tiesenhausen
George C. Marshall Space
Flight Center
National Aeronautics and Space
Administration
MC PS01
Marshall Space Flight Center,
Alabama 35812
(205) 453-2789; FTS: 872-2789

APPENDIX C

DISNEY WORKSHOP PARTICIPANTS

APPENDIX C

DISNEY WORKSHOP PARTICIPANTS

Jerry Aldrich
Epcot Center
P.O. Box 40
Orlando, Florida 32830
(305) 827-7294

Norm Doerges
Epcot Center
P.O. Box 40
Orlando, Florida 32830
(305) 828-1550

Richard Fox
WED Enterprises
1401 Flower Street
Glendale, CA 91201
(818) 956-7723

Kurt Haunfelner
WED Enterprises
1401 Flower Street
Glendale, CA 91201
(818) 956-7689

Frank Jones
Reedy Creek Utilities District
P.O. Box 40
Orlando, Florida 32830
(305) 824-4189

Tom Jones
WED Enterprises
1401 Flower Street
Glendale, CA 91201
(818) 956-6700

Robert Kohl
Reedy Creek Utilities District
P.O. Box 40
Orlando, Florida 32830
(305) 824-4026

Lou Kompare
Epcot Center
P.O. Box 40
Orlando, Florida 32830
(305) 828-2626

Bruce Laval
Epcot Center
P.O. Box 40
Orlando, Florida 32830
(305) 828-2276

Doug LeBlanc
WED Enterprises
1401 Flower Street
Glendale, CA 91201
(818) 956-6526

Henry Robitaille
Epcot Center
P.O. Box 40
Orlando, Florida 32830
(305) 827-7256

Andrew Schuerger
Epcot Center
P.O. Box 40
Orlando, Florida 32830
(305) 827-7256

Ben Schwegler
WED Enterprises
1401 Flower Street
Glendale, CA 91201
(818) 956-7691

Jon Sinkinson
Walt Disney World
P.O. Box 40
Orlando, Florida 32830
(305) 824-6322

Willard Smith
Reedy Creek Utilities District
P.O. Box 40
Orlando, Florida 32830
(305) 824-4952

John Zovich
WED enterprises
1401 Flower Street
Glendale, CA 91201
(818) 956-7718